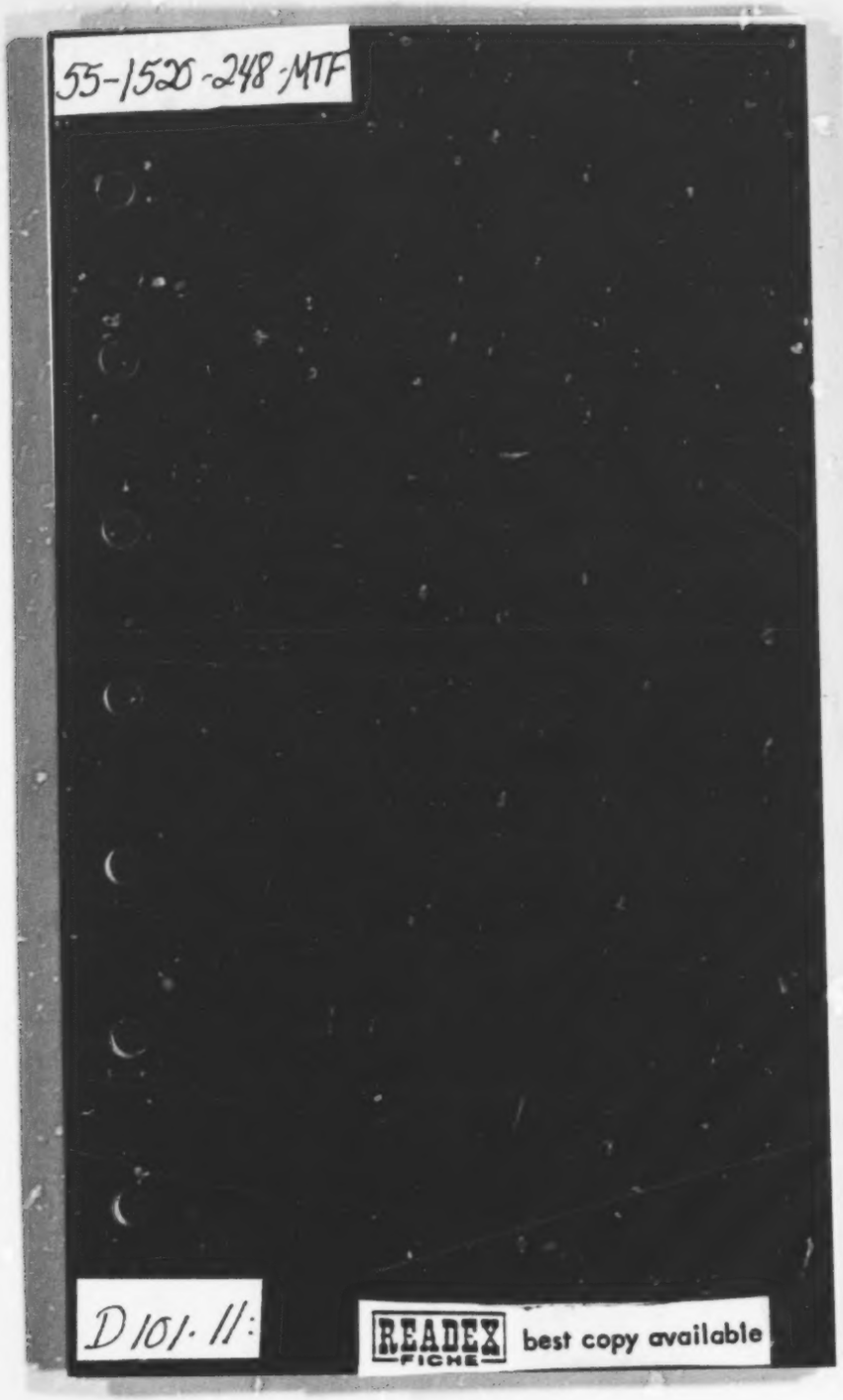
55-1520-248-MTF
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WARNING

A maintenance test flight is an exceptionally demanding operation and requires a thorough flight readiness inspection (PREFLIGHT). The flight readiness inspection is prescribed in TM 55-1520-248-10 Operator's Manual and must be completed prior to each maintenance test flight. Emergency procedures are found in the applicable -10 or checklist (-CL) and are not duplicated in this publication. Prior to each maintenance test flight, the pilot will contact maintenance/quality control personnel to determine the maintenance that has been performed. This manual should be used only by qualified maintenance test flight pilots as required in AR 95-1.

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of the applicable Aircraft Operator's Manual (when using the 2028-2 from the Operator's manual, ensure the publication number and title reflect this MTF) direct to Commander, US Army Aviation Systems Command, Attn: AMSAV-MPSD, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished to you.

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SECTION I. INTRODUCTION

1. **Purpose.** The purpose of this manual is to provide complete instructions for performing maintenance test flights of OH-58D helicopters. For the specific conditions which require a general or limited maintenance test flight, refer to the following manuals:

TM 55-2840-256-23
TM 55-1500-328-25
TM 55-1520-248-23
TM 11-1520-248-23
TM 9-1240-778-20
TM 9-1240-778-30
TM 9-4935-780-13
TM 9-1427-779-20
TM 9-1427-779-30

2. **Definition.**

a. **Maintenance Test Flight.** A functional test flight for which the primary purpose is to determine whether the airframe, power plant, accessories and other equipment are functioning in accordance with predetermined requirements while subjected to the intended environment.

b. **Warnings, Cautions, and Notes.** Warnings, Cautions, and Notes are used to emphasize important and critical instructions and are used for the following conditions:

WARNING

An operating procedure, practice, etc., which, if not correctly followed, will result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed, will result in damage to or destruction of equipment.

NOTE

An operating procedure, condition, etc., which is essential to highlight.

3. General Information.

a. This manual covers only maintenance test flights of OH-58D helicopters and in no way supersedes any information contained in TM 55-1520-248-10 or -CL, but is to be used in conjunction with the -10 and -CL. For the purpose of maintenance test flights only, this manual satisfies all the requirements of the -CL for "Before Starting Engine Checks" through "Engine Shutdown Checks."

b. Crew requirements will be as specified in TM 55-1500-328-25 and TM 55-1520-248-10.

c. The duration of the general or limited test flight will be in accordance with the requirements of TM 55-1500-328-25.

4. Special Instructions.

a. **Cargo and Passengers.** Cargo and passengers are prohibited on maintenance test flights.

b. **Forms and Records.** Forms and records will be checked prior to the maintenance test flight to determine maintenance performed and type of maintenance test flight required (i.e., general or limited).

c. **Configuration.** The configuration of the helicopter should be determined prior to each maintenance test flight in order to determine performance parameters.

d. **Post Test Flight Inspection.** A thorough visual inspection will be performed to the extent necessary to assure that deficiencies or shortcomings that may have developed as a result of the maintenance test flight are detected.

e. **References.** When a maintenance test flight is required to assure proper operation of a specific system(s), refer to the applicable maintenance manual for the limits of that system.

f. **Asterisked Checks.** An asterisk (*) prior to a check requires that the Test Flight Check Sheet be annotated with a specific reading. Also a check (✓) for satisfactory performance or an (X) for problem detected will be recorded and a short statement entered in the remarks block of the Check Sheet.

g. **Maintenance Test Flight Check Sheet.** The Check Sheet contained in Section V will be used for all test flights. When a test flight is performed for the purpose of determining if specific equipment or systems are operating properly, completion of only that portion of the maintenance test flight Check Sheet applicable to the specific equipment or systems being tested is required. The helicopter test flight Check Sheets may be locally reproduced. Continuation sheets may be used when necessary. Items that prove to be unsatisfactory during the test flight, and require corrective action, shall be listed in the remarks block during flight and transferred to DA Form 2408-13 immediately after termination of the flight. The sheet will be attached to DA Form 2408-13 upon completion. After accumulation of two or more sheets, the data should be reviewed to determine if trends are developing.

SECTION II. MAINTENANCE TEST FLIGHT CHECKLIST

General. This section contains the maintenance test flight requirements peculiar to Army model OH-58D helicopters. Conditions requiring accomplishment of test flights shall be in accordance with TM 55-1500-328-25. The requirements contained herein are established to assure a thorough inspection of the helicopter before flight, during flight and upon completion of the maintenance test flight. The right side of the checklist (Troubleshooting Reference) is cross-indexed to the troubleshooting guides contained in Section III. A dash between references means "thru"; a comma means "and". The references list the possible abnormal conditions, indications or malfunctions which could be encountered while performing the procedure.

PROCEDURE	TROUBLESHOOTING REFERENCE
PRIOR TO MAINTENANCE TEST FLIGHT	
1. Forms and Records — Check.	
2. A thorough flight readiness inspection in accordance with the requirements contained in TM 55-1520-248-10 — Performed.	
3. Special Pre-Flight Checks — Accomplished.	

PROCEDURE	TROUBLESHOOTING REFERENCE

INTERIOR BEFORE STARTING ENGINE

1. Antitorque pedals — Adjust as required, check full travel.
2. Cyclic — Check full travel of adjustment knob. Maximum FWD adjustment — Two complete turns from full AFT position.
3. Seat belt and shoulder harness — Fasten and adjust.
4. Shoulder harness inertia reel and lock — Check operation and leave unlocked.
5. Utility lights — As required, secured.
6. HEAT rheostat — Check for smooth operation and contact of both stops. Turn off (counterclockwise).
7. Circuit breakers and switches — Set as follows:
   a. Circuit breakers — As required.
   b. CONSOLE LT and INST LT rheostats — Check smoothness of operation, set as desired. C17
   c. FLOOD LT rheostat and switch — Check smoothness of operation, set as desired. C17
   d. POS light — As required. C15, 16
   e. ANTI COLL light switch — ANTI COLL. C14

PROCEDURE	TROUBLESHOOTING REFERENCE

INTERIOR BEFORE STARTING ENGINE (CONT)

f. PITOT HTR switch — OFF.

g. HTR switch — OFF.

h. L DEFOG BLWR switch — OFF.

i. R DEFOG BLWR switch — OFF.

j. COMPT BLWR switch — OFF.

k. FUEL BOOST switch — OFF.

l. ENG ANTI ICE switch — OFF.

m. ENG OIL BYPASS switch — OFF.

n. ESNTL BUS switch — START.

o. AC GEN switch — OFF.

p. DC GEN switch — OFF.

q. BATT 2 switch — OFF.

r. BATT 1 switch — OFF.

8. FUEL valve handle — Check for smoothness of operation, positive on/off position, threads in witness hole, cotter pins present, and cracks and excessive grooves on lever arm. Leave in forward (on) position and lock into detent.

PROCEDURE	TROUBLESHOOTING REFERENCE

INTERIOR BEFORE STARTING ENGINE (CONT)

*9. Free air temperature (FAT) gage — Check condition and note FAT.

10. RFD — Check condition.

11. RPM, TGT and TRQ vertical scale indicators — Check condition.

12. Pilot MFD — Check condition.

13. Pilot MFD auxiliary control panel — Check condition, inclinometer full of fluid, no cracks.

14. Clock — Condition, operation, set.

15. Radar warning indicator — Check condition.

16. Magnetic compass — Check condition, full of fluid, no discoloration, compensated within last 12 months.

17. Standby altimeter — Check condition and set to field elevation.

18. Standby attitude indicator — Check condition and caged.

19. Standby airspeed indicator — Check condition, static indication, range markings:

Red line	—	125 kts.
Green arc	—	20 to 125 kts.
Yellow arc	—	0 to 20 kts.

PROCEDURE	TROUBLESHOOTING REFERENCE

INTERIOR BEFORE STARTING ENGINE (CONT)

20. MPD — Check condition.
21. MFK — Check condition, ZERO and EMER switch covers down.
22. Pilot CSC — Check and set as desired.
23. Compass (ASN-43) — MAG.
24. Radar warning (APR-39) — OFF.
25. Ignition switch — ON.
26. Fuel control panel — Check condition and cover down.
27. SCAS control panel — Check condition and set switches as follows:
    a. SCAS PWR switch — OFF.
    b. SCAS PITCH/ROLL, YAW switches — Spring-loaded OFF.
    c. FORCE TRIM switch — FORCE TRIM.
    d. HYD SYS switch — HYD SYS.
28. Collective control switches — Set as required.
    a. RMT ICS — ICS.
    b. START switch — OFF.
    c. SRCH LT — OFF.

PROCEDURE	TROUBLESHOOTING REFERENCE
INTERIOR BEFORE STARTING ENGINE (CONT)	
29. Flight controls — Check as follows:	
a. Cyclic friction — Off.	
b. Collective — Down and unobstructed, friction off.	H5
c. Antitorque pedals — Check freedom of travel. Center pedals.	H3,4
30. Throttle — Check full travel and idle detent, return to closed position.	E1, 7
NOTE	
Initial page displays on pilot MFD when battery power is applied.	
31. BATT 2 switch — BATT 2.	C2
32. BATT 1 switch — BATT 1.	C2, 3, 11, 12
NOTE	
Initial page displays on both MFDs when external power is applied.	
33. GPU — Connect as required (DC only).	B1
34. MFD — Check ENGINE OUT audio activated and initial page displayed.	C7, 8
35. Caution, warning and advisory messages — Review and acknowledge.	

PROCEDURE	TROUBLESHOOTING REFERENCE

INTERIOR BEFORE STARTING ENGINE (CONT)

36. TAMS BIT — Press.

*37. CWA HISTORY page — Review and clear when appropriate.

*38. ENGINE HISTORY page — Review, record, and clear when appropriate.

39. MPD — Check.

NOTE

DGT OFF position will prevent digits from being displayed where appropriate.

a. Vertical scale instruments — Check static indications and range markings.

(1) TEST switch — TEST position, vertical scales will completely illuminate.

(2) TRQ:

Green light	— 0 to 100%
Blue light	— 100 to 135%
Red dot	— 100%
Digital readout	— 888

PROCEDURE	TROUBLESHOOTING REFERENCE

INTERIOR BEFORE STARTING ENGINE (CONT)

(3) TGT:

Green light	— 200 to 785 °C
S	— 927 °C
T	— 871 °C
Red dot	— 785 °C
Yellow/white range	— 716 to 785 °C
Digital readout	— 888

(4) NP:

Green light	— 0 to 107%
Blue light	— 107 to 120%
Red dot	— 107%

(5) NR:

Green light	— 0 to 100%
Blue light	— 100 to 120%
Red dots	— 90 and 107%
Green line	— 97 to 100%

(6) XMSN Oil Pressure:

Green light	— 0 to 70 PSI
Blue light	— 70 to 75 PSI
Red dots	— 30 and 70 PSI

(7) XMSN Oil Temperature:

Green light	— -10 to 110 °C
Blue light	— 110 to 140 °C
Red dots	— 15 and 110 °C

PROCEDURE	TROUBLESHOOTING REFERENCE

INTERIOR BEFORE STARTING ENGINE (CONT)

(8) ENG OIL Pressure:

Green light	— 0 to 130 PSI
Blue light	— 130 to 150 PSI
Red dots	— 50 and 130 PSI
Yellow/white range	— 50 to 90 PSI

(9) ENG OIL Temperature:

Green light	— -10 to 107 °C
Blue light	— 107 to 140 °C
Red dots	— 0 and 107 °C

(10) FUEL QTY:

Green light	— 0 to 750 lbs.
Yellow/white range	— 0 to 100 lbs.

(11) NG:

Green light	— 0 to 105%
Blue light	— 105 to 115%
Red dot	— 105%
Digital readout	— 188.8

(12) Selectable digital display — Check digital readouts indicate 888 and all indicator lights illuminated.

PROCEDURE	TROUBLESHOOTING REFERENCE

INTERIOR BEFORE STARTING ENGINE (CONT)

b. Selectable digital display — Check for following indications and leave in BATT V and START V. Each pair of system indicators is displayed by repeated pressing of the SEL switch. As each pair is called up, the appropriate indicator light will illuminate and digital readouts display as follows:

NR	At or near 0	
NP	At or near 0	
FUEL QTY	Note indication	
ENG TRQ %	At or near 0	
AC V	At or near 0	
RECT V	At or near 0	
RECT LD %	At or near 0	
S. GEN LD %	At or near 0	B2
BATT V	Note indication	
START V	Above 10 (when starter is engaged)	

c. BRT — Check rheostat through full range and set. As desired.

40. CPO CSC — Check, set as desired.

41. MMS control panel switches — Set as follows:

a. MMS mode selector switch — OFF.

b. VIDEO toggle switches — AUTO, except focus (FOC).

PROCEDURE	TROUBLESHOOTING REFERENCE

INTERIOR BEFORE STARTING ENGINE (CONT)

c. LASER FIRST/LAST switch — As desired.

d. LASER OFF/STANDBY/ARM switch — OFF.

42. CPO MFD — Check condition.

43. CPO MFD auxiliary control panel — Check condition, switches OFF.

44. RPM switch — Decrease (-) for 10 seconds. C13

45. FUEL BOOST switch — FUEL BOOST.

NOTE

A FUEL BOOST caution message before or during start will not be cause for aborting the start or grounding the helicopter.

ENGINE START

1. Fireguard — Posted.

2. Rotor blades — Clear and untied.

CAUTION

If BATT V goes below 10 volts during starting cycle, the CDS, engine instruments and ESC will not operate properly. Abort the start.

Refer to TM 55-1520-248-10 for engine starting limits. Abort start if abnormal conditions are noted.

PROCEDURE	TROUBLESHOOTING REFERENCE
ENGINE START (CONT)	

CAUTION

If a fuel control caution/advisory message displays, use modulated start procedures. Monitor TGT and NG to avoid exceeding limits. Temperature and overspeed limiting may not be automatically controlled. Engine starting under these conditions should be used only when helicopter evacuation or trouble-shooting becomes necessary.

NOTE

If BATT V goes below 20 volts, MFDs may temporarily go blank, but this is normal. Monitor TGT and NG. CDS and fuel control will function properly. Continue start.

NOTE

FUEL BOOST FAIL caution message appears momentarily, then extinguishes. D2

3. Engine Start — Accomplish as follows:

   a. START switch — Press and hold. Start time. A1

   b. BATT V and START V — Check above 10 volts.

   c. TGT — 150 °C or less.

PROCEDURE	TROUBLESHOOTING REFERENCE
ENGINE START (CONT)	
NOTE	
Use modulated start procedure when single battery starts are to be attempted and DC external power is not connected.	
d. Throttle.	
(1) Automatic start — Advance to idle at 12% NG.	
(2) Modulated start — Advance slowly at 12% NG and modulate throttle to maintain TGT within limits. Advance to idle after TGT has decreased from original peak.	
*e. TGT — Monitor for overtemperature condition and record peak indication.	A2, 3, 5
f. ENG OIL pressure — Check rising by 20% NG or abort start.	
g. Rotor blades — Check turning by 25% NG or abort start.	A4, 6
h. Flight controls — Collective down, cyclic and pedals centered.	
*i. START switch — Release at 55% NG. Record start time.	
j. NG — Check stabilized at idle, 63 to 65%.	E5

PROCEDURE	TROUBLESHOOTING REFERENCE
ENGINE START (CONT)	
k. NR/NP — Check indication.	
l. Engine and transmission instruments — Within limits.	
ENGINE RUNUP — PILOT	
1. DC GEN switch — DC GEN. Check CPO MFD activates and initial page displays. Select VSD.	C7, 8 D1
2. AC GEN switch — AC GEN.	
3. FUEL BOOST switch — OFF.	
4. ESNTL BUS switch — RUN.	C12
5. GPU — Disconnect (if used).	
NOTE Ensure compass controller synchronization knob causes heading tape on CPO MFD to move. When nulled the magnetic compass heading tape and standby compass should correlate.	
6. Gyro Compass — Nulled.	
NOTE Navigation accuracy can be degraded when FAST ALIGN is used to align AHRS. Therefore, only NORMAL ALIGN should be used to align AHRS when precise navigation is required.	
7. Pilot MFD NAV ALIGN key — Press. Initiate NAV alignment. Check pitch ladder displayed on CPO MFD.	C6

PROCEDURE	TROUBLESHOOTING REFERENCE

ENGINE RUNUP – PILOT (CONT)

8. COMPT BLWR switch — AUTO.

9. Standby attitude indicator — Uncaged.

SYSTEM CHECK

1. MPD BIT switch — BIT hold in BIT. Press to RST and release upon completion of built-in-test.

2. RFD — Press TEST key and verify test pattern displays.

CAUTION

Limit cyclic and pedal movement to 2 inches maximum displacement from center.

3. Force trim check.

FORCE TRIM switch — FORCE TRIM. Check for positive feeling of force gradient springs. No loose play allowed. Check for approximately equal forces needed to offset cyclic into lateral and fore and aft positions. Check operation of both cyclic force trim interrupter switches. Note correlation of both cyclic sticks. Check antitorque pedals in the same manner.	G2, 4 H3, 4 8, 9, 13

PROCEDURE	TROUBLESHOOTING REFERENCE
SYSTEM CHECK (CONT)	
4. Cyclic check.	
NOTE	
CPO cyclic must be locked out prior to check.	
a. FORCE TRIM switch — OFF. Check for creep. Check for freedom of movement. No binding or restriction allowed.	H1, 2, 11, 12
*b. Use spring scale to check all quadrants for equal force of 1 ±0.5 pound. FORCE TRIM switch — FORCE TRIM.	H1, 2 11
c. Cyclic friction check — Friction full on. FORCE TRIM switch — OFF. Assure cyclic can be moved without excessive force. FORCE TRIM switch — FORCE TRIM. Friction — Off. CPO cyclic — Reengaged.	H11
5. Collective check.	
a. Raise collective a maximum of one-half inch. Use spring scale to check built-in friction of 2 to 6 pounds. Collective down.	G2, 4 H6
b. Raise collective to mid travel while checking for binding and hard spots in upper portion of travel. Observe control reaction and that LOW HYD PRESSURE caution message does not display. Collective down.	G2, 4 H6, 7

PROCEDURE	TROUBLESHOOTING REFERENCE
SYSTEM CHECK (CONT)	
c. Collective friction — ON. An acceptable increased force should be required to move the collective. Collective — down, friction — off.	H5, 6, 7

CAUTION

CPO shall guard flight controls while the following step is performed.

*6.	Antitorque pedal check. FORCE TRIM — OFF. Check built in friction for 3 to 4 pounds and record.	H3, 4
7.	Hydraulic system check.	

CAUTION

Before any movement of controls with the hydraulic system off, both hands must be on the controls.

Brief CPO not to remove his hand from hydraulic system switch unless instructed to do so. Be prepared for possible up forces on collective. If up forces are excessive, return switch to on. This condition must be corrected before continuing.

Limit cyclic and pedal movement to 2 inch maximum displacement.

a. HYD SYS switch — Off. Acknowledge caution audio message only.

PROCEDURE	TROUBLESHOOTING REFERENCE

SYSTEM CHECK (CONT)

NOTE

Feedback forces will be encountered when moving the cyclic stick. If hydraulic servos are functioning properly, negligible forces will be required to maintain a given stick position once the stick is stopped.

b.	Cyclic — Check for unusual forces or feedback while moving cyclic 45 degrees right forward then back to neutral, 45 degrees left forward and return cyclic to neutral.	G3
c.	Collective — Check that collective can be moved up about midtravel and moved full down.	G3
d.	Antitorque pedals — Check right and left pedals for binding. Pedals should be aligned when centered.	G3, H17
e.	HYD SYS circuit breaker — Out. LOW HYD caution message deleted and pressure restored.	
f.	HYD SYS switch — HYD SYS.	
g.	HYD SYS circuit breaker — In. FORCE TRIM switch — FORCE TRIM.	

PROCEDURE	TROUBLESHOOTING REFERENCE

SYSTEM CHECK (CONT)

8. Engine idle speed check.

   a. DC GEN switch — OFF. Check idle stabilized at 63 to 65% NG.

NOTE

For cold temperature starts, if ENG and/or TRANS oil pressures are above limits or ENG and TRANS oil temperatures are below limits, do not accelerate engine above idle.

   b. Pilot throttle — Increase approximately 5% then return to idle. NG should return to 63 to 65%.

NOTE

Dual control installation requires an idle speed check from the CPO throttle.

NOTE

Pilot throttle travel is double travel of CPO throttle. Idle speed may be approximately 0.5% NG higher on CPO throttle twist grip, but no lower.

   c. CPO throttle — Increase slightly then return to idle. Indication should be within 63 to 65%.

   d. DC GEN switch — DC GEN.

PROCEDURE	TROUBLESHOOTING REFERENCE
SYSTEM CHECK (CONT)	
9. Fuel control overspeed check.	
NOTE Fuel control fault codes will only be displayed if BIT page is selected prior to check.	
a. MPD SEL switch — Select NR/NP.	
b. Throttle — Advance to 75 to 80% NP.	
NOTE Digital/Analog test is disabled above 81% NP.	
c. DIGITAL test button — Press and hold momentarily; note decrease in TGT, NG, and NP then return to normal. FUEL CONTROL advisory message should momentarily appear.	D3
d. ANALOG test button — Press and hold momentarily; note decrease in TGT, NG, and NP then return to normal.	D3
10. Throttle — Full open and check as follows:	C10, E3
a. Low RPM audio comes on at approximately 80% NR.	
b. Verify AC generator enables at 95 ± 2% NR.	

PROCEDURE	TROUBLESHOOTING REFERENCE
SYSTEM CHECK (CONT)	
c. Low RPM audio goes off at 95 ± 2% NR.	
d. NR stabilized at 96 ± 2%.	J3
e. Check for high frequency vibrations.	
f. Verify correlation between engine oil pressure and NG.	
11. NP speed check — Position RPM switch on pilot collective to increase (+). NP should increase to 102 ± 2%. Adjust NP to 100%.	C13, E2
12. Mast torque — Check. At flat pitch and 100% NR torque should be 25 to 30% if main rotor blade pitch is set correctly for autorotation.	

CAUTION

Do not exceed 107% NR. Overspeed protection will not be provided while fuel control circuit breakers are pulled. All throttle movements should be smooth and continuous.

13. HIGH RPM ROTOR warning — Check as follows:

    a. Throttle — Reduce to idle.

    b. FUEL CONT DIGT circuit breaker — Pull, note cautions/advisories.

PROCEDURE	TROUBLESHOOTING REFERENCE
SYSTEM CHECK (CONT)	

c. FUEL CONT ANALOG circuit breaker — Pull.

d. Throttle — Open slowly to 107% NR maximum. Note that HIGH RPM ROTOR warning displays on both MFDs and that audio warning sounds by 107% NR. Reduce throttle to idle.

e. FUEL CONT DIGT and ANALOG circuit breakers — In and note FUEL CONT cautions/advisories deleted.

f. Throttle — Full open 100% NR.

NOTE

AHRS must be aligned before SCAS check.

14. SCAS System — Check as follows:

a. Verify AHRS FAIL deleted from MFD.

b. SCAS PWR switch — PWR.

c. PITCH/ROLL switch — PITCH/ROLL.

d. YAW switch — YAW.

e. Pilot SCAS REL switch — Press. Observe SCAS DISENG displayed on MFD.

PROCEDURE	TROUBLESHOOTING REFERENCE

SYSTEM CHECK (CONT)

f. PITCH/ROLL switch — PITCH/ROLL.

g. YAW switch — YAW.

h. CPO SCAS REL switch — Press. Observe SCAS DISENG displayed on MFD. Repeat steps f. and g.

CAUTION

Limit cyclic and pedal movements to 2 inch maximum displacement.

15. SCAS TEST — Check as follows:

a. FORCE TRIM switch — OFF.

b. INIT switch — Press.

c. SCAS CHECK key — Press.

d. SCAS TEST switch — Press. Observe SCAS CHECK IN PROGRESS displays on MFD. After 5 to 6 seconds, PITCH/ROLL and YAW SCAS switches will automatically cycle to OFF.

NOTE

Do not move flight controls until both SCAS switches are OFF.

PROCEDURE	TROUBLESHOOTING REFERENCE

SYSTEM CHECK (CONT)

NOTE

To ensure a valid test, maintain the following cyclic and pedal position inputs steady until completion of test.

e. Cyclic — Displace right 1.5 inch and aft 1.5 inch.

f. Pedals — Displace right 1 inch.

g. MFD — PREFLT COMPLT, SCAS DISENG and CAUTION displayed.

NOTE

Due to tolerances inherent to the SCAS system, random failures of the SCAS test may be indicated. If a SCAS test failure is encountered, three subsequent consecutive successful SCAS test operations are sufficient to verify that the SCAS system is operational.

h. PITCH/ROLL switch — PITCH/ROLL.

i. YAW switch — YAW.

WARNING

Do not activate L or R portion of heading hold switch. Unguarded pedals could position to left or right mechanical stops.

PROCEDURE	TROUBLESHOOTING REFERENCE

SYSTEM CHECK (CONT)

NOTE

AHRS must be aligned prior to heading hold check.

16. Heading hold — Check as follows:

    a. Heading hold switch — ENGA. Observe HDG HLD displayed on MFD.

    b. Antitorque pedals — Move. Observe HDG HLD deleted from MFD.

    c. Heading hold switch — ENGA. Observe HDG HLD displayed on MFD.

    d. Heading hold DISENG — Press. Note antitorque pedals move freely and HDG HLD deleted from MFD.

    e. FORCE TRIM switch — FORCE TRIM.

17. MPD SEL switch — Select RECT LD %/S GEN LD %.

18. COMPT BLWR — Check as follows:

    a. COMPT BLWR switch — OFF — Then ON. Note increase in S GEN LD %. Note blower motor operates properly and check for excessive noise in headset, caused by blower motor or noise suppressor failure.

PROCEDURE	TROUBLESHOOTING REFERENCE
SYSTEM CHECK (CONT)	
b. COMPT BLWR switch — AUTO. Note blower operation above 37°C FAT only.	
19. DEFOG & VENT — Check as follows:	C4
a. R DEFOG BLWR switch — R DEFOG BLWR. Note increase in S GEN LD %. Note blower motor operates properly and check for excessive noise in headset, caused by blower motor or noise suppressor failure. Check proper operation of defog and vent pull levers.	
b. Repeat step a. for L DEFOG BLWR.	
20. Heater check — HTR switch ON, check no TGT increase or warming air from outlets. Rotate heater rheostat switch to increase, check for TGT increase and warming air from outlets near base of pilot and CPO cyclic sticks. Close outlets and check for warming air from defog vents. R and L DEFOG BLWR switch — OFF, defog and vent levers push in, HTR switch — OFF. Check for decrease in TGT and S GEN LD %. Set HTR switch as required.	
21. PITOT HTR switch — PITOT HTR. Check for increase in S GEN LD % and PITOT HEAT ON advisory	C9

PROCEDURE	TROUBLESHOOTING REFERENCE
SYSTEM CHECK (CONT)	
message displays on MFD. Switch OFF. Note decrease in S GEN LD % and message deleted. Set switch as required.	
22. Fuel Boost Pump — Check as follows:	D2
a. FUEL BOOST switch — FUEL BOOST. Note FUEL BOOST FAIL caution should display and then delete.	
b. FUEL BOOST circuit breaker— Pull. Note FUEL BOOST FAIL caution and audio may activate, then delete. Ensure NG remains stabilized.	
c. FUEL BOOST circuit breaker — Push. Ensure S GEN LD % does not increase more than 3%.	
NOTE	
Fuel boost is required at or above pressure altitudes of 12,000 feet.	
d. FUEL BOOST switch — As required.	
23. ENG ANTI ICE — Check as follows:	
a. ENG ANTI ICE switch — ENG ANTI ICE. Check for increase in TGT and ENG ANTI-ICE ON advisory displayed on MFD.	E4

PROCEDURE	TROUBLESHOOTING REFERENCE
SYSTEM CHECK (CONT)	
b. ENGINE ANTI ICE switch — OFF. Note decrease to normal TGT and advisory deleted.	
c. ENG ANTI ICE circuit breaker — Pull to check fail-safe system. Note increase in TGT and ENG ANTI-ICE ON advisory displayed on MFD. Push circuit breaker in. Note decrease in TGT and advisory deleted. Set switch as required.	
24. BATT PRHT indicator lights — Press to test.	C1
25. MPD SEL switch — Select FUEL/ ENG TRQ.	E6

NOTE

Complete operational checks of MMS special equipment will be covered in Section IV Special Procedures.

NOTE

FDL menu will not be displayed if weight on gear switch does not sense helicopter on ground.

NOTE

As BIT checks complete cycle, note any failure codes and refer to appendices.

PROCEDURE	TROUBLESHOOTING REFERENCE

SYSTEM CHECK (CONT)

26. BIT checks — Accomplish as follows and note failure codes:

    a. INIT switch — Press.

    b. FDL MENU key — Press.

    c. BIT key — Press.

NOTE

Wait until individual BIT is completed before selecting next BIT or previous BIT will cancel.

    d. CDS key — Press.

    e. DOPP key — Press.

    f. ATHS key — Press.

NOTE

Note RALT reading less than five feet on CPO MFD.

    g. RALT key — Press. Check GO displays and note reading increases to 1000 ± 100 ft on CPO MFD. As altimeter decreases below 180 feet, verify analog bar decreases to zero. Set high altitude warning for 200 feet and low altitude warning for 180 feet.

    h. AHRS — Verify GO.

PROCEDURE	TROUBLESHOOTING REFERENCE
SYSTEM CHECK (CONT)	
i. MAST TQ key — Press. Mast torque indication should increase to 110%, CAUTION should display and counter [nn] should increment.	
j. FM-1 key — Press.	
k. UHF key — Press.	
l. VHF key — Press.	
m. HF key — Press.	
n. FM-2 key — Press.	
o. ADU key — Press.	
p. IFM key — Press.	
q. MUX BUS status — Check.	C5
27. Avionics — Check as follows:	
a. Radios — Check and set as a minimum two preset frequencies for each radio.	K1, 2, 3
b. Pilot collective radio switches — Select each radio and note position of arrow. Channel UP/DOWN in each radio selected, note frequencies change.	
c. CIPH key on RFD — Check for correct operation.	K3, 4

PROCEDURE	TROUBLESHOOTING REFERENCE
SYSTEM CHECK (CONT)	
d. CPO CSC — Select each radio and channel UP/DOWN.	
e. Secure radio equipment — Configure for operation and check if installed.	
f. IFF — Set and test.	K6-11

NOTE

Doppler accuracy will be affected if not updated at least every 10 km.

28. Navigation waypoints — Select a minimum of three waypoints approximately 10 ±1 km apart, preferably points surveyed and accurate within eight digits.

29. Flight plan — Construct using previously selected waypoints.

30. ATHS — Refer to Section IV, Special Procedures.

BEFORE HOVER CHECKS

1. Throttle — Full open, 100% NP.

2. RADAR WARNING (APR-39) — Test as required. See operating procedures in TM 55-1520-248-10 Operator's Manual. K5

PROCEDURE	TROUBLESHOOTING REFERENCE
BEFORE HOVER CHECKS (CONT)	
3. SCAS — Engaged.	
4. Warnings, cautions and advisories — Review and acknowledge.	
*5. Systems — Check and record following:	E6
a. XMSN OIL P	
b. XMSN OIL T	
c. ENG OIL P	
d. ENG OIL T	
e. NG	
f. ENG TRQ	
g. TGT	
h. MAST TRQ	
6. Standby altimeter — Set barometric pressure and compare with field elevation. Altimeter indication should be within 70 feet below 5000 feet pressure altitude.	
7. MFD — Select VSD and set PITCH and ROLL switches. BRT and CONT as desired.	
8. Cyclic and collective friction — As desired. Recommended off.	

PROCEDURE	TROUBLESHOOTING REFERENCE

BEFORE HOVER CHECKS (CONT)

9. Force trim — As desired. Recommended off.

NOTE

The higher the selected power level, the more accurate the test will be.

*10. Power assurance check — Perform and record. — E8

HOVER CHECKS

1. Takeoff to hover — Carefully bring helicopter to a 2 foot hover. Monitor control response and CG hang as helicopter leaves ground. Controls should be in proper position for conditions and power required. — H14-16 J1, 2

*2. Hover power check — While at a stabilized 2 foot hover into the wind, record mast torque, TGT, and NG. Readings should be normal for conditions. Check torque with PPC.

3. Check parking area for indication of leaks.

NOTE

Verify flight instruments are functioning properly.

4. Slowly hover to test flight hover area.

PROCEDURE	TROUBLESHOOTING REFERENCE

HOVER CHECKS (CONT)

5. Control rigging check.

   a. With helicopter heading into the wind, check controllability of the tail rotor by making 90 degree pedal turns left and right.

   b. With helicopter into the wind, perform sideward flight in both directions to check cyclic response and rigging. Limit ground speed to 5 knots.

   c. While maintaining five feet AGL, fly forward into the wind until effective translational lift is reached. Check cyclic response and rigging, abnormal vibrations, and/or flight control displacement.

6. Gyro compass calibration — As required. See Section IV for detailed procedures.

7. SCAS check — With helicopter at a stabilized 3 foot hover into the wind check as follows:

   a. Check pitch and roll SCAS by making fore, aft, and lateral cyclic inputs of approximately 1 inch.

   b. Check yaw SCAS by making left and right pedal inputs of approximately 1 inch.

PROCEDURE	TROUBLESHOOTING REFERENCE

HOVER CHECKS (CONT)

c. Repeat steps a. and b. with SCAS off to verify SCAS improved flight characteristics.

d. SCAS PITCH/ROLL and YAW switches — ENGAGE.

8. Heading hold check — With helicopter at a stabilized 3 foot hover into the wind, engage HDG HLD. Helicopter should maintain heading within ± 2 degrees. Increase collective moderately. Stabilize at a 10 foot hover and note that heading remains constant. Descend to a 3 foot hover, move HDG HLD button right and left to check for normal operation. Apply slight pressure to antitorque pedals. HDG HLD should disengage automatically.

9. Land helicopter.

CAUTION

Brief CPO to hold HYD SYS switch throughout following check. Should cyclic jam or become hard to move, instruct CPO to turn HYD SYS switch OFF, then ON. If cycling the switch does not release controls, turn HYD SYS switch OFF and accomplish a hydraulics off landing.

PROCEDURE	TROUBLESHOOTING REFERENCE

HOVER CHECKS (CONT)

10. Power cylinder check.

    Climb and maintain a 10 foot hover. Smoothly move cyclic along a straight line from left rear to right forward. The length of the stroke should be approximately 3 inches either side of center. No restrictions to movement should be felt and the LOW HYD PRESS caution message should not illuminate. This check is primarily a flow capacity check of the hydraulic pump. Repeat the procedure moving from right rear to left forward then return to normal hover altitude. — G1, 2, 4

CAUTION

Do not exceed helicopter operating limits during power applications.

CAUTION

Manually reduce throttle to idle prior to switching from fuel control modes to prevent overspeed.

11. Engine response and fuel control check.

    a. Digital fuel control — From a stabilized 3 foot hover, while

PROCEDURE	TROUBLESHOOTING REFERENCE

HOVER CHECKS (CONT)

maintaining instruments within normal ranges, make a positive increase in collective. NP and NR should remain constant. NG should increase then stabilize. Increase should occur in less than 1 second. Stop climb before excessive altitude is gained and land helicopter.

b. Analog fuel control check — With helicopter on the ground, reduce throttle to idle, raise the fuel control switch cover, and move switch to BACK UP position. Note fuel control caution and advisory messages. Increase throttle to full open position. NR/NP should stabilize 2 to 3% higher. Move RPM switch to + and - position. NR/NP should remain constant. Bring helicopter to a hover and make a rapid increase in collective. NR/NP may droop slightly during application of collective and increase during reduction of collective, but should stabilize. Reduce collective to avoid excessive altitude then descend and land helicopter.

c. Fuel control switch — Reduce throttle to idle. Move fuel control switch to NORM ANLG position. Fuel control caution and advisory should cancel. Rotate throttle to full open. NR should be 100%.

PROCEDURE	TROUBLESHOOTING REFERENCE

HOVER CHECKS (CONT)

12. HOVER/HOVER BOB-UP — Perform as follows from stabilized 3 foot hover:

    a. MFD — Select hover/hover bob-up page. Note acceleration cue and hover box positioning. Move helicopter and observe hover box indicates original helicopter position.

NOTE

Doppler calibration is only required if excessive drift is noted.

    b. Doppler CAL key — Press and allow doppler to calibrate.

BEFORE TAKEOFF CHECKS

1. NR — 100%.
2. Caution, warning, and advisory system — Review and acknowledge.
3. Systems instruments — Check normal ranges.
4. Fuel — Check quantity.
5. MPD SEL switch — Check all indications, set to FUEL QTY/ENG TRQ position. Fuel quantity should agree with reading on vertical scale indicators.

PROCEDURE	TROUBLESHOOTING REFERENCE

BEFORE TAKEOFF CHECKS (CONT)

6. Transponder — As required.

*7. NAV UPD key — Press. Perform over known point and record.

INFLIGHT CHECKS

CAUTION

If excessive vibrations are felt or other indications exist that preclude further safe flight, land and/or return to maintenance area and correct before continuing.

1. Takeoff.

   a. Perform a normal takeoff. Check that control position and instrumentations are normal for conditions. — J1, 2 H15

   b. RAD/ALT HIGH altitude limit check. Climb to 210 feet AGL using radar altimeter. Radar altimeter scale disappears at 200 ± 10 feet and HI indicator flashes.

   c. Initiate fuel consumption check.

PROCEDURE	TROUBLESHOOTING REFERENCE

INFLIGHT CHECKS (CONT)

2. Control rigging check.

NOTE

Perform checks 2. thru 9. into the wind.

The helicopter may be in a slight climb or dive during flight control check depending on conditions.

a. SCAS REL switch — Press.

b. While maintaining helicopter in trim, using 80% mast torque, increase airspeed to 100 KIAS. FORCE TRIM — ON. Check that cyclic remains in place when hand pressure is relaxed. FORCE TRIM — OFF. — H10, 15

NOTE

Pedal displacement check must be made from pilot position only.

c. With FORCE TRIM OFF and heading hold DISENG, check pedal position. Normal pedal position is neutral to 1.5 inches of right pedal. Relax pedal pressure. Pedals should not creep. — H17

PROCEDURE	TROUBLESHOOTING REFERENCE

INFLIGHT CHECKS (CONT)

3. Hydraulic system check.

WARNING

Bank angles exceeding 45 degrees without hydraulic boost may cause roll rates to exceed controllable limits.

CAUTION

Brief CPO not to remove hand from HYD SYS switch until instructed to do so. If any control problems or abnormal forces are encountered, the CPO should be instructed to place the HYD SYS switch to HYD SYS position.

a. While maintaining approximately 80 KIAS turn HYD SYS switch OFF. Note SCAS FAIL and LOW HYD PRESS caution messages displayed, acknowledge. Check that helicopter pitch and roll attitude can be maintained with no abnormal force present. More force should be required to move the cyclic right forward than left forward. G3

b. Decrease and increase collective to check that at least 17% down and 83% up mast torque can be reached without excessive force. Do not exceed any limitations

PROCEDURE	TROUBLESHOOTING REFERENCE
INFLIGHT CHECKS (CONT)	
during this check. Check tail rotor controllability by maintaining helicopter in trim during the collective check.	G3,H18
c. Stabilize helicopter and relax pressure on controls.	
d. HYD SYS switch — HYD SYS.	
e. SCAS PITCH/ROLL and YAW switches — ENGAGE.	

CAUTION

Do not exceed any operating limitations.

4. Collective anticipator — Check as follows:

   a. NR — 100%.

   b. Collective — While maintaining 70 KIAS, reduce to 78% NG and allow to stabilize, then make a smooth increase of collective up to 85% mast torque in not less than 5 seconds. Note NR droop does not exceed 4%.

PROCEDURE	TROUBLESHOOTING REFERENCE

INFLIGHT CHECKS (CONT)

*5. Autorotation rpm.

WARNING

If autorotation rpm cannot be maintained in the normal operating range, terminate the test flight.

CAUTION

Autorotation will be entered at an altitude that will allow power recovery to be completed prior to reaching 500 feet AGL.

NOTE

Ensure engine anti-ice and/or bleed air systems are off prior to next check.

a. While keeping a suitable landing area within reach at all times, enter autorotation at 55 KIAS into the wind. Do not allow NR to exceed limits. Stabilize autorotation and note NG and NP, and record NR. NR shall be stabilized between 98 and 100% with two crewmembers and normal fuel load. Check adequate pedal to maintain trim and that no unusual cyclic position is required to maintain desired attitude. Note vibration

PROCEDURE	TROUBLESHOOTING REFERENCE

INFLIGHT CHECKS (CONT)

level or marked decrease in vibration level. Mast torque should be approximately 0%, ENG TRQ % should be at or near 0%. Note no unusual noises.

b. Perform power recovery by increasing throttle to open position using care not to cause an overspeed condition.

6. Engine Performance check — TBD.

NOTE

Eliminate or minimize all main rotor vibrations prior to the following checks.

7. Vibration analysis — Complete. (See Section VI for detailed procedures and Section III, J, Troubleshooting References). — F1, J1-3

8. VSD page — Check for proper indications, no excessive fluctuations. Check that standby flight instruments correspond with VSD page indications.

9. MPD — Check normal indications. — B2

10. MPD SEL switch — Check for normal indications. Leave in FUEL QTY/ ENG TRQ and record fuel quantity and time for fuel consumption check.

PROCEDURE	TROUBLESHOOTING REFERENCE

INFLIGHT CHECKS (CONT)

11. Avionics — Check each radio to determine proper operation. Two frequencies should be used. — K1-3

12. Secure radio equipment — See generic operating procedures in TM 55-1520-248-10 Operator's Manual, and Section III for Trouble-shooting Procedures. Check if installed. — K4

13. Transponder — See operating procedures in TM 55-1520-248-10 Operator's Manual and accomplish checks as follows: — K6-11

    a. Contact ATC for transponder check to include emergency.

    b. IFF — Check if installed.

14. ATHS — Check if installed. See Section IV Special Procedures.

BEFORE LANDING CHECKS

1. NR — 100%.
2. Systems — Check.
3. Crew — Check.
4. Landing light — As required.

NOTE

During descent note that radar altimeter scale reappears and LO indicator flashes at 180 ± 10 feet.

PROCEDURE	TROUBLESHOOTING REFERENCE

AFTER LANDING CHECKS

1. Landing light — As required.
2. Transponder — STBY.

NOTE

If position error is excessive, see Section IV, Special Procedures under Navigation System Check.

*3. Present Position — Check. Land to takeoff point and record.

4. MMS operational check — Perform as required. See Section IV, Special Procedures.

ENGINE SHUTDOWN CHECKS

1. Flight controls — Cyclic centered, pedals neutral, collective down.
2. FORCE TRIM switch — FORCE TRIM. H8
3. Control frictions — On.
*4. Systems — Check and record as follows: E6
   a. XMSN OIL P
   b. XMSN OIL T
   c. ENG OIL P

PROCEDURE	TROUBLESHOOTING REFERENCE

ENGINE SHUTDOWN CHECKS (CONT)

d. ENG OIL T

e. NG

f. ENG TRQ

g. TGT

h. MAST TRQ

i. BATT V

*5. FDL MENU — Check as follows:

a. BIT page — Fuel control test, check recall page, note error codes.

b. CW HISTORY — Review and note failures.

c. ENGINE HISTORY — Review, note indications and record limits exceeded.

CAUTION

If throttle is inadvertently rolled to the off position, do not reopen. Perform a hot start emergency shutdown if it appears that TGT limits will be exceeded.

6. Throttle — Reduce slowly to idle for 2 minutes minimum and check the following:

a. LOW RPM ROTOR warning message displays at 97 to 96% NR.

PROCEDURE	TROUBLESHOOTING REFERENCE

ENGINE SHUTDOWN CHECKS (CONT)

b. Main rotor rpm warning audio activates below 95 ± 2% NR.

c. AC GEN FAIL and RECT FAIL messages activate at 91 to 88% NR.

7. NG — Check stabilized at 63 to 65%.

8. BATT 1/BATT 2 — Check as follows:

a. MPD SEL switch — Select RECT LD %/S GEN LD %.

b. BATT 1 switch — OFF.

c. S GEN LD % — Check and note indication.

d. BATT 2 switch — OFF. Check S GEN LD % for an excessive decrease.

e. BATT 1 switch — BATT 1. Check S GEN LD % for an excessive increase.

NOTE

Fluctuations of 3% or less indicate a fully charged battery.

f. BATT 2 switch — BATT 2.

9. AC GEN switch — OFF.

PROCEDURE	TROUBLESHOOTING REFERENCE

ENGINE SHUTDOWN CHECKS (CONT)

10. Standby attitude indicator — Caged.

11. SCAS PWR switch — OFF.

NOTE

Allow TGT to stabilize for 2 minutes prior to next check.

12. Throttle — Reduce to 1/8 inch below flight idle stop. Engine shall not quit and NG shall remain stabilized for 15 seconds.

13. Throttle — OFF. Monitor for residual fires and note following:

    a. ENGINE OUT warning — Displays below 55 ± 3% NG.

    b. LOW OIL PRESS ENG caution — Displays below 50 PSI.

    c. LOW OIL PRESS XMSN caution — Displays below 30 PSI.

14. ESNTL BUS switch — START after NG goes below 10%.

15. Overhead switches — OFF except batteries and required lights.

PROCEDURE	TROUBLESHOOTING REFERENCE

ENGINE SHUTDOWN CHECKS (CONT)

NOTE

Volatile memory will be lost if battery power is lost or turned off prior to NG passing below 30%.

16. BATT 1 and BATT 2 switches — OFF after main rotor has stopped. Ensure that NG reads 0%.

17. IGN switch — OFF and remove key as required.

BEFORE LEAVING HELICOPTER

1. Doors — Close immediately after exiting helicopter.

2. Main rotor blades — Tied down.

3. Helicopter covers — Installed.

4. Post flight inspection — Completed.

NOTE

All entries from "REMARKS" column of check sheet transcribed to DA Form 2408-13.

5. MTF check sheet — Signed.

6. Secure helicopter.

7. Maintenance personnel — Debrief as necessary.

SECTION III. TROUBLESHOOTING GUIDE

General. This section contains troubleshooting information that has been referenced in Section II checklists.This section lists possible conditions, abnormal conditions and indications, and causes. This information is limited to immediate actions and is not all encompassing. Complete troubleshooting procedures can be found in the appropriate maintenance manuals.

Refer to Troubleshooting in TM 55-2840-256-23 and TM 55-1520-248-23.

TROUBLESHOOTING GUIDE A — STARTING

CONDITION

PROBABLE CAUSE

A1. Engine will not crank or fails to reach 12% NG.

a. Starter/ignition lock switch not on.

b. START or IGN circuit breaker out.

c. Battery cable connector not properly connected.

d. Battery cable connector corroded.

e. Battery power low.

f. GPU underrated.

A2. Engine fails to light off.

a. IGN circuit breaker out.

b. Fuel valve handle off.

c. Air in fuel lines.

A3. Acceleration temperature too high during start.

a. Residual TGT in excess of 150 °C prior to start.

b. Battery weak.

c. Leaking engine anti-icing valve or lines.

d. Obstructed air inlet.

e. Dirty particle separator or compressor.

f. Throttle improperly rigged.

g. Electronic control system failure.

h. Defective starter which is not capable of dry motoring gas producer NG above 15%.

i. FOD or erosion to compressor.

A4. Main rotor not turning by 25% indicated NG, no NP indication, but normal NG and TGT indications.

a. Main or tail rotor tied down.

b. Foreign object binding main or tail rotor drive.

c. Transmission or gearbox failure.

d. NP turbine failed or locked.

e. Engine gear failure.

A5. Unintentional start termination.

a. Starter switch released too soon.

b. START or IGN circuit breaker opened.

c. FUEL VALVE shut off.

d. Starter failure (electrical or mechanical).

e. Ignition system failure.

f. Fuel control malfunction.

A6. Main rotor not turning by 25% indicated NG: Normal NG, NP, and TGT indication.

a. Free wheeling unit failure.

b. Engine driveshaft failed.

c. Transmission failure.

TROUBLESHOOTING GUIDE B — INSTRUMENTS

CONDITION

PROBABLE CAUSE

B1. DC EXT power connected, power will not come on line.

a. DC GEN switch in GEN position.

b. Defective GPU.

B2. S GEN LD % does not appear on MPD.

a. Defective wiring or connector(s) between right MCPU and generator shunt.

b. Internal component malfunction as determined by CDS FDLS/BIT operational check.

TROUBLESHOOTING GUIDE C — ELECTRICAL

CONDITION	PROBABLE CAUSE
C1. Battery 1 or 2 BATT PRHT ON light not lit during Press-to-Test.	
	a. Defective Press-to-Test lamp.
	b. Defective battery.
	c. 9TH CELL circuit breaker out.
C2. Battery 1 or 2 BATT PRHT ON light is lit at temperature above -10 °F, FAT.	
	Defective battery.
C3. CPO MFD will not come on with MFD CPO circuit breaker closed, BATT 1 switch in BATT 1 position, and ESNTL BUS switch in RUN position.	
	a. Defective ESNTL BUS switch.
	b. Defective wiring or connector(s) in bus system.
C4. Left (right) defog blower does not operate.	
	a. Defective or open DEFOG BLWR circuit breaker.
	b. Defective L DEFOG BLWR (R DEFOG BLWR) switch.
	c. Defective wiring or connector(s) in defog blower system.
	d. Defective left (right) blower.

C5. CDS BIT provides NO GO error codes on MFD when checking MUX data bus.

Refer to Appendix Table A-1.

C6. MFK operation fails to enter data inputs on MFD.

a. Defective MFK.

b. Defective wiring or connector(s) to MFK.

c. Defective MCPU (left or right).

C7. CPO MFD does not operate with DC GEN or DC external power on.

a. Defective or open MFD CPO circuit breaker.

b. Defective or open BUS INTCON circuit breaker.

c. Defective left MCPU.

C8. MFD does not display initial page on power up and image is not legible and/or clear.

a. Adjust bright control knob for maximum brightness.

b. Defective MFD.

c. Defective MCPU.

C9. Pitot tube will not heat.

a. Defective or open PITOT HTR circuit breaker.

b. Defective PITOT HTR switch.

c. Defective pitot heater.

C10. Transformer rectifier unit does not come on.

a. Defective or open RECT circuit breaker.

b. Defective ground at RECT circuit breaker, RECT RCCB, or TRU.

c. Defective wiring or connector(s) in system.

d. Defective TRU RCCB.

e. Defective TRU.

C11. Battery 1 will not come on with BATT 1 switch set to BATT 1.

a. Defective battery 1.

b. Internal component malfunction as determined by DC external power operation check.

c. Defective BATT 1 switch.

d. Defective battery 1 relay.

e. Defective charger monitor.

f. No ground wire jumper installed with battery charger removed.

g. Defective ground at charger monitor.

h. Defective ground at battery terminal.

C12. MFD (CPO) does not come on with ESNTL BUS switch in RUN position.

a. BRT control not properly adjusted.

b. Defective ESNTL BUS switch.

c. Defective left MCPU.

C13. Collective RPM switch adjustment does not increase and/or decrease engine rpm.

a. Fuel control switch in analog position.

b. Defective switch.

c. Defective wiring/connector(s).

d. Defective fuel control.

C14. Anticollision light(s) fail to illuminate.

a. Defective switch.

b. Defective/open circuit breaker.

C15. Position lights malfunction when POS switch is placed to BRT position.

a. Lamp filament open (burned).

b. Defective circuit breaker.

c. Defective switch.

C16. Position lights fail to burn or fail to go dim with switch in DIM position.

a. Defective dimming resistor.

b. All of item C15 above.

C17. Instrument or console lights fail to brighten or dim as INST LTS or CONSOLE LTS knob is rotated.

a. Defective instrument lights control transformer.

b. Defective INST/CONSOLE LT trim/balance potentiometer.

c. Defective circuit breaker.

d. Defective wiring/connector(s).

TROUBLESHOOTING GUIDE D — CAUTION/ WARNING/ADVISORY SYSTEM

CONDITION	PROBABLE CAUSE
D1. INV FAIL caution message displayed on MFD and 115 is not displayed under ACV on MPD.	
	a. Defective inverter.
	b. Defective or open INV circuit breaker.
	c. Defective or open 26 VAC PWR circuit breaker.
	d. Defective inverter relay.
D2. FUEL BOOST FAIL caution message does not come on momentarily with FUEL BOOST switch ON.	
	a. Defective fuel pressure switch.
	b. Defective left MCPU.
D3. FUEL CONTROL advisory message does not come on during test.	
	a. Defective wiring/connector(s).
	b. Defective keyboard.
	c. Defective fuel control panel switch.
	d. Defective MCPUs.

TROUBLESHOOTING GUIDE E — POWER PLANT

CONDITION

PROBABLE CAUSE

E1. Throttle stiff.

a. Throttle friction too tight.

b. Defective flexible cable or cable improperly routed.

c. Flexible cable clevis too tight.

d. Foreign object obstructing control movements.

e. Fuel control shaft binding.

E2. At full open throttle and full governor increase, NP RPM not correct (not getting a 6% spread).

Electronic control system failure.

E3. Governor RPM too high or low at full open throttle.

Electronic control system failure.

E4. No change in TGT when ENG ANTI ICE switch is turned ON or OFF (increase of 5 to 10 °C will ensure proper operation).

a. ENG ANTI ICE circuit breaker out or defective.

b. Bleed leakage in line to engine anti-icing solenoid valve.

c. Faulty switch or wiring.

d. Defective anti-icing solenoid.

E5. Compressor stall, fluctuating engine instruments, during start.

a. Loose pneumatic fittings.

b. Px and Py orifices clogged or dirty.

c. Electronic control system failure.

d. Dirty compressor.

E6. Torquemeter too high or too low at flat pitch and 100% NP RPM. (Normal approximately 18%.)

a. Improper initial pitch change links setting.

b. Torquemeter gage defective.

E7. Unable to move throttle to below engine idle.

a. IDLE REL button malfunction.

b. Throttle controls binding.

c. Throttle improperly rigged.

d. NG fuel control malfunction.

e. CPO collective stick not properly installed.

E8. Low power assurance troubleshooting procedure.

a. A % Health, from step e. of Power Assurance Check of Hover Checks, less than 100 indicates the engine may be weaker than that modeled in computing aircraft performance for the Operator's Manual. The crew may elect to proceed with the mission after this advisement; for instance, the crew may decide a 98% minimum

engine is good enough for the flight. In any case, an indicated weak engine is a candidate for replacement. Before engine replacement, the following additional steps are recommended for verification prior to engine changeout.

b. Check TGT and QE indications for proper accuracy and calibration.

c. Inspect engine inlet for cleanliness and FOD evidence.

d. Wash engine.

e. Inspect engine for compressor air leakage, bleed air leakage, fuel control pneumatic leakage (anti-icing and overspeed control lines and "B nuts"), combustor case leakage, transfer tube flange leakage, etc.

f. Repeat power assurance check.

TROUBLESHOOTING GUIDE F — ROTORS (POWER TRAIN)

CONDITION	PROBABLE CAUSE
F1. Excessive pylon motion.	
	a. Failed elastomeric corner mount.
	b. Failed elastomeric fore and aft pylon spring.
	c. Failed pylon beam.
	d. Failed pylon attachment structure.
	e. Failed attachment bolts not torqued to specification.

TROUBLESHOOTING GUIDE G — HYDRAULIC

CONDITION	PROBABLE CAUSE
G1. Excessive feedback in flight or during power cylinder check, HYD SYS switch — HYD SYS.	
	a. Feedback in collective and cyclic.
	(1) Air in system.
	(2) Excessive out-of-track or out-of-balance rotor system.
	(3) Low pump pressure.
	(4) Main pressure relief valve defective.
	b. Feedback felt in one flight control or cyclic jams during rapid movement.
	(1) Loose servo assembly or attaching bolts.
	(2) Excessively worn rod end bearings.
	(3) Defective servo.
	(4) Servo pilot valve malfunction.
	(5) Pump malfunction, low pressure, or low fluid level.
	(6) FOD in flight controls.
G2. Flight controls do not operate smoothly.	
	a. Sticking servo control valve.
	b. Pivot bolts in input lever are sticking or over-torqued.

c. Low pump pressure.

d. Air in system.

e. Pump one-way check valve improperly installed.

G3. Excessive feedback with HYD SYS switch OFF.

a. Excessive out-of-track or out-of-balance of main rotor.

b. Irreversible valve malfunction.

c. Air in irreversible chamber.

d. Pilot valve malfunction.

G4. Unable to move controls sufficiently (HYD SYS switch — HYD SYS).

a. Defective servo.

b. Improper rigging or controls jammed.

TROUBLESHOOTING GUIDE H — FLIGHT CONTROLS

CONDITION	PROBABLE CAUSE
H1. Cyclic binding in certain areas with FORCE TRIM OFF.	
	a. Wiring harness binding at base of cyclic stick.
	b. Foreign matter in base of stick.
	c. Foreign matter under deck.
	d. Rough spot in friction device.
	e. Rod end bearings worn or dirty.
H2. With FORCE TRIM OFF, cyclic continues moving after small force applied or moves without cyclic input.	
	a. Moves forward or aft only.
	(1) Cyclic centering spring improperly adjusted.
	(2) Improperly rigged force gradient.
	b. Moves mostly in a 45 degree angle.
	(1) Servo cylinder control head bolts too tight.
	(2) Defective servo.
	c. Moves with less than 0.5 pound of force. Friction improperly adjusted.

H3. Pedals binding.

a. Foreign matter binding forward controls under center console.

b. Rod end bearing malfunction.

c. Control tube binding on phenolic block in tailboom.

d. Excessive friction applied on antitorque pedal friction device.

H4. Excessive play in pedals.

a. Worn pitch change mechanism.

b. Worn tube rod end bearings or pedal adjuster assembly.

H5. Unable to increase collective friction using pilot adjustable friction device.

a. Friction knob improperly adjusted.

b. Threads need cleaning.

H6. Collective built-in friction too light or too heavy.

Friction nut/clamp at jackshaft not adjusted properly.

H7. Collective stick binds and sticks or has abnormal breakaway force.

a. Friction device worn or rough, or improperly adjusted.

b. Electrical wire harness at base of collective fouling.

c. Obstruction of collective by CPO seat belt.

d. Obstruction of push-pull tubes from collective to swashplate.

e. Defective servo.

H8. Any magnetic brake fails to energize with FORCE TRIM switch in FORCE TRIM position.

Defective magnetic brake.

H9. Magnetic brake fails to deenergize when FORCE TRIM switches are pressed.

a. Defective switch.

b. Wiring is shorted out, grounded.

H10. Force trim weak, stiff or allows play in cyclic and/or pedals.

a. Improper built-in spring tension adjustment.

b. Improperly rigged.

c. Magnetic brake inoperative.

d. Wrong gradient spring assembly installed.

e. Cap nut with lockwire is not properly adjusted.

f. Spring tension out of adjustment.

H11. Excessive friction on cyclic with force trim released.

a. Adjustable friction not completely off.

b. Foreign matter in base of stick.

c. Magnetic brake unit stiff (dragging).

H12. Defective trim holds in same position with FORCE TRIM switch in OFF position.

a. Magnetic brake binding.

b. Defective wiring at switches.

c. Improperly rigged.

H13. Force trim inoperative.

a. Defective switches.

b. Open circuit breaker.

c. Open or shorted wire.

d. Defective magnetic brake.

e. No electrical power going to magnetic brake.

H14. Unable to get normal cyclic travel.

a. Improperly rigged cyclic or collective.

b. Control components improperly installed.

c. Force trim improperly rigged.

H15. Cyclic position abnormal for flight condition.

Cyclic improperly rigged.

H16. Cyclic stick not centered in stable hover.

a. Fore and aft CG not within limits.

b. Lateral CG not within limits.

c. Cyclic improperly rigged.

H17. Pedal creep.

a. Dynamic balance incorrect.

b. Helicopter not into wind.

H18. Unable to obtain a minimum of 83% up and/or 17% down mast torque during collective (HYD SYS OFF) check.

a. Collective binding.

b. Maximum power reached prior to 83% mast torque.

c. Defective or improperly installed elastomeric bearing.

d. Improperly installed main rotor hub.

TROUBLESHOOTING GUIDE I — NOT APPLICABLE

TROUBLESHOOTING GUIDE J — VIBRATIONS

CONDITION

PROBABLE CAUSE

NOTE

See Section IV, F for detailed information on vibrations.

J1. Low frequency vibrations.

NOTE

Low frequency vibrations are divided into two groups: laterals and verticals.

a. Laterals.

(1) Blades of unequal weight.

(2) Blades of unequal flight time.

(3) Blades from different environments.

(4) Moisture in blades.

(5) Improper filling/repair techniques.

(6) Improper balancing techniques.

(7) Blades out of balance.

(8) Blades out of track.

b. Verticals.

(1) 1/rev (6 to 7 cps, i.e., 395 rpm ÷ 60 sec = 6.6 cps).

(a) Excessively worn parts.

(b) Improper tracking techniques.

(c) Weak trim tabs.

(2) Main rotor and control induced 4/rev (24 to 28 cps).

(a) Insufficient friction on swashplate uniball.

(b) Excessively loose control linkage or swashplate parts.

(c) Deteriorated or separated corner mount; worn transmission isolation mount attachment bolt or bearing.

(d) Excessive degrees of trim tab on one or more blades.

J2. Pylon and fuselage induced medium frequency vibration (25 to 30 cps).

a. Skids or crosstubes loose.

b. Unstowed equipment.

c. Horizontal stabilizer attachment bolts loose.

d. Vertical fin attachment bolts loose.

e. Any loose airframe components.

f. Airframe skin is oil canning.

J3. High Frequency Vibration.

a. Tail rotor hub and blade assembly unbalanced.

b. Worn or loose tail rotor blade bearing.

c. Worn tail rotor trunnion.

d. Loose or worn tail rotor pitch change link bearing.

e. Bent tail rotor pitch change link.

f. Loose tail rotor retaining nut.

g. Loose or worn tail rotor pitch change slider.

h. 90-degree gearbox alignment or failure.

i. Retaining bolts of 90-degree gearbox loose.

j. Loose bolts in flexible couplings.

k. Worn spline adapters.

l. Tail rotor driveshaft bent/out of alignment.

m. Shaft hanger bearing rough or failed.

n. Loose hanger bearing housing.

o. Oil cooler fan unbalanced or failed.

p. Engine malfunction.

q. Generator bearing failure.

r. Freewheeling unit failure.

s. Engine oil pump failure.

t. Loose engine mounts.

u. Main input shaft coupling failure.

v. Main transmission malfunction.

w. Hydraulic pump failure.

x. Transmission oil pump failure.

TROUBLESHOOTING GUIDE K — COMMUNICATION/NAVIGATION EQUIPMENT

CONDITION	PROBABLE CAUSE
K1. Radios inoperative.	
	a. Circuit breaker out.
	b. Headset not plugged in completely.
	c. Radios improperly tuned.
	d. ICS panel malfunction.
	e. Connector disconnected or broken.
	f. Radio malfunction.
	g. Antenna wire disconnected or crossed.
	h. CDS malfunction.
	i. ADU malfunction.
K2. ICS Panel malfunction.	
	a. ICS panel defective.
	b. ICS panel disconnected.
	c. Headset not plugged in completely.
	d. Circuit breaker out.
	e. ADU malfunction.

K3. No. 1 FM radio inoperative.

a. KY-58 dummy plugs not installed.

b. KY-58 not turned on.

K4. KY-58 and KY-75 malfunction.

a. Sets are zeroized.

b. Codes not set correctly.

c. Mode incorrectly set.

d. ADU malfunction.

e. Sets not connected properly.

f. Circuit breaker out.

K5. AN/APR-39 malfunction.

a. Defective circuit breaker.

b. Defective radar warning control panel.

c. Defective azimuth indicator.

d. Defective comparator.

e. Defective dual receiver.

K6. AN/APX-100 IFF no output in any mode of operation.

a. Circuit breaker open or defective.

b. Mode key on IFF page set to OFF or STBY.

c. Defective cable or loose connections.

d. Defective fuse in receiver-transmitter.

e. Defective receiver-transmitter.

K7. AN/APX-100 IFF indication weak or intermittent in any or all modes of operation.

a. Power supply in receiver-transmitter abnormal.

b. Receiver-transmitter coder operations abnormal.

K8. AN/APX-100 IFF improper response from one mode. All others normal.

a. Applicable mode enable key on IFF page in OUT position.

b. Improper code setting.

c. Defective receiver-transmitter.

K9. AN/APX-100 IFF ANT illuminates in the self-test mode.

a. Defective coaxial antenna cable connector.

b. Defective receiver-transmitter.

K10. AN/APX-100 IFF KIT illuminates when Mode 4 is operated.

a. Defective transponder computer.

b. Defective receiver-transmitter.

c. Defective wiring.

K11. AN/APX-100 IFF ALT illuminates.

a. Defective altimeter encoder.

b. Defective receiver-transmitter.

c. Defective wiring.

SECTION IV. SPECIAL PROCEDURES

General. This section contains special procedures which were referenced in Section II.

A. Calibration Procedures — Gyromagnetic Compass.

NOTE

Magnetic compass must be accurate prior to complete gyromagnetic compass calibration. Refer to DA PAM 738-751.

Compass calibration should be performed away from metal buildings and other areas that may affect compass headings.

MFDs for pilot and CPO are identical. Use one MFD to represent compass calibration data and instructions. Use the other MFD to call up and display heading information. Perform two consecutive normal navigation alignments on the same spot gyromagnetic compass calibration is to be performed to stabilize true heading.

1. CPO MFD FDL MENU key — Press.
2. GROUND SETUP key — Press.
3. Pilot MFD HSD key — Press.
4. CPO MFD COMPASS CAL key — Press.
5. CPO MFD — Observe prompting message.
6. MFK — Enter magnetic variation value to 0.1 degree accuracy.

NOTE

Valid magnetic variation cannot exceed ± 25 degrees.

Only actual numbers, decimal points, and minus signs, where applicable, are entered through the numeric section of the keyboard. No preceding and/or succeeding filler zeroes need to be added for entry of any numeric value.

East or positive magnetic variation values are not preceded by a polarity or correctional sign. West or negative magnetic variation values must be preceded by a minus sign entry (key located to the left of ENTER key on keyboard).

7. Helicopter — Position at a low hover to heading in prompting message within 2 degrees.

NOTE

The current heading is displayed beneath the prompting message.

8. Compass controller synchronization knob — Turn to center annunciator.

9. MFK ENTER key — Press when compass is synchronized and stable.

NOTE

AHRS and compass heading data is displayed on pilot MFD for reference.

10. Steps 7, 8, and 9 — Repeat for each prompting message displayed on CPO MFD (36 headings, 10 degrees apart).

NOTE

When the last heading data is taken, the system automatically computes a correction curve and displays a prompting message indicating completion of the compass calibration procedure.

11. MFK ENTER key — Press to complete compass calibration.

12. CPO MFD MENU key — Press to exit.

NOTE

SCAS will disengage when circuit breakers are pulled.

13. AHRS DC and AHRS AC circuit breakers — Pull.

NOTE

HSD page compass heading is displayed on pilot MFD.

14. Compare pilot MFD HSD page compass heading with standby compass heading. They should agree within ± 2 degrees.

15. AHRS DC and AHRS AC circuit breakers — Push.

16. Helicopter — Land.

17. Navigation alignment — Perform.

18. SCAS system — Reengage.

B. Navigation System Check.

1. Waypoints — Select as follows:

NOTE

Accuracy of surveyed points will have a direct influence on the navigation system check.

a. Three UTM map coordinates must be surveyed accurate to within eight digits.

b. Coordinates must be located such that each flight leg is 10 ± 1 kilometers.

c. Coordinates must be suitable for hovering over (NAV UPDATE).

2. Enter waypoints into waypoint list.

3. Construct Flight Plan from these three waypoints and enter into Flight Plan.

NOTE

Severe flight maneuvers, such as NOE flight, will degrade NAV system accuracy.

4. Fly smoothly to waypoints and perform NAV UPDATE at each waypoint.

5. Return to first waypoint. Hover over the landmark and record present position easting and northing without updating. This measures position error of the system.

6. Compute circular position error as follows:

   a. Easting error (E) = Surveyed (actual) Easting coordinates less NAV system Easting coordinates.

   b. Northing error (N) = Surveyed (actual) Northing coordinates less NAV system Northing coordinates.

   c. Circular error = $\sqrt{E^2 + N^2}$

   Example: Coordinates

   Surveyed (actual) 10S PK 4816 5719
   NAV System 10S PK 4818 5722

   E = 4816–4818 = –2 (20 meters)
   N = 5719–5722 = –3 (30 meters)

   Circular error = $\sqrt{(-2)^2 + (-3)^2} = \sqrt{4 + 9} = \sqrt{13}$

   = 3.6 (36 meters)

7. Circular error computed in step 6. shall be less than 8.0 (80 meters). If a particular test shows greater error than above, repeat the entire procedure. Occasional errors greater than 8.0 (80 meters) are allowed but should be consistently less for an acceptable system.

8. Computation of circular position error is invalid if any of the following are true:

   a. Waypoint coordinates are incorrect.

   b. Severe flight maneuvers are performed.

   c. Waypoints are greater than 10 ±1 kilometers apart.

C. **MMS Operational Checks.**

WARNING

Do not fire LASER Rangefinder/Designator except in approved areas.

NOTE

If any of the following checks fail, refer to TM 9-1240-778-20.

1. Preflight Check.
   a. MMS Subsystem circuit breakers — In.
   b. AHRS Alignment — Verify.
   c. CPO Aux panel, DSC, LMC, TIS INTEG, and ALFGL switches — OFF.
   d. CPO MFD MMS switch — Press.
   e. MMS mode select switch — PREFLT.
2. TVS Video Test.
   a. Video AUTO/MAN switches set — AUTO.

NOTE

FOC AUTO/MAN video is spring loaded to MAN position.

   b. TV/TIS switch — Press to select TV video.
   c. VIDEO AUTO/MAN switches set — MAN.

d. VIDEO SYM INTEN MFD rocker switch — Cycle and observe that alphanumeric character intensity adjusts.

e. VIDEO SYM INTEN MMS rocker switch — Cycle and observe that LOS reticle intensity adjusts.

f. VIDEO LEVEL rocker switch — Cycle and observe that TVS brightness adjusts.

g. VIDEO FOC rocker switch — Cycle and observe that TVS focus adjusts.

h. VIDEO rocker switches — Set as desired for best display on MFD.

3. Mechanical Test.

a. CPO INIT switch — Press.

b. FDL MENU key — Press.

c. MAINTAINER CHECKS key — Press.

d. MMS DIAGNOSTICS key — Press.

e. MECHANICAL TEST key — Press. Verify MMS line of sight varies through azimuth and elevation limits (±190° and ±30°, respectively), and video field of view and focus on MFD vary as test progresses, and TEST COMPLETE message displays.

best copy available

4. Symbology Test.

a. MMS DIAGNOSTICS switch — Press.

NOTE

Duration of each symbol display is approximately three seconds. If test sequence does not finish, an MSP failure has occurred.

b. SYMBOLOGY Test switch — Press.

c. Symbols and display — Check condition as test is sequenced.

(1) TVS symbols — Check NFOV limit, LOS reticle, laser hit point reticle, and target acquisition gate displays.

(2) TIS symbols — Check NFOV limit, LOS reticle, laser hit point reticle, and target acquisition gate displays.

(3) TVS LOS reticle — Check reticle revolves around center of display.

(4) TIS LOS reticle — Check reticle revolves around center of display.

(5) Laser hit point reticle — Check reticle revolves around center of display.

(6) Target acquisition gate — Check gate revolves around center of display.

(7) SEQUENCE COMPLETE message — Displayed ON MFD.

d. MENU key — Press. Check FDL MENU page displayed.

5. TIS Video Test.

NOTE

Wait until TIS HOT message deletes before continuing checks. (About 15 minutes maximum after MMS is turned on.)

a. TV/TIS switch — Press to select TIS video.

b. VIDEO LEVEL switch — Cycle and check TIS intensity adjusts.

c. VIDEO GAIN switch — Cycle and check TIS video contrast adjusts.

d. VIDEO FOC switch — Cycle and check TIS focus adjusts.

e. VIDEO rocker switches — Set as desired for best display on MFD.

f. LOS CONT switch — Steer MMS to target with low contrast image

g. DSC switch — ALE.

h. DSC switch — OFF after horizontal bands disappear.

i. ALFGL switch — ON. TIS image detail increases in hot or cold areas of the target.

j. ALFGL switch — OFF after confirming operation.

k. TIS INTEG switch — ON. Check TIS image has less video noise.

l. TIS INTEG switch — INCR. Check TIS video noise decreases while observing video change rate on MFD.

m. TIS INTEG switch — OFF.

n. FOV SEL switch — Press. Check for four fields of view. UP for wide and wide 2X, then down for narrow and narrow 2X.

o. FR FRZ switch — Press. Check TIS images freeze to frame being displayed. LOS will not change picture.

p. FR FRZ switch — Press to unfreeze TIS image.

q. MMS mode select switch — FWD.

r. W HOT/B HOT key — Press. Check image polarity changes.

s. DCLTR key — Press. Check MFD symbology deletes.

WARNING

If OBS fails to deploy or comes out of deployment STOP FIRING! DO NOT FIRE LASER.

6. Boresight Test.

a. MMS mode select switch — PREFLT.

b. INIT switch — Press.

c. MMS key — Press.

d. LASER ARM/STBY/OFF switch — ARM.

e. BRST AUTO switch — Press. Check LOS reticle is displayed. TV and TIS image of resolution target displays and deletes.

CAUTION

If resolution image remains on MFD, do not perform next step, damage to target will result.

f. LASER fire switch — Press.

(1) Check LOS reticle is centered on hot spot and BRST message displays while routine is in progress for both sensors.

(2) Check BRST COMPLETE message displays.

(3) LASER fire switch — Release. If checks are good proceed to step 6.o. If REBORESIGHT message is displayed perform manual boresight.

NOTE

Manual boresight is not enabled unless mode select switch is in PREFLT.

g. BRST MAN key — Press. Check message is displayed. Wait for resolution target to delete.

h. LASER fire switch — Press and hold while using LOS CONT switch to steer LOS reticle to hot spot.

i. BRST MAN key — Press to deselect manual boresight.

j. TV/TIS switch — Press to select other sensor.

k. BRST MAN key — Press to reselect manual boresight.

l. LASER fire switch — Press and hold. Use LOS CONT switch to steer LOS reticle to hot spot.

m. BRST MAN key — Press to deselect.

n. Repeat steps 6.e. and f., and accomplish an automatic boresight.

o. LASER ARM/STBY/OFF switch — OFF.

7. Forward Mode Test.

a. MMS mode select switch — FWD.

b. MNL/SLAVE switch — Press to select FWD. Check MMS slews forward to 0 degrees azimuth and elevation when MMS reaches fixed FWD position with a FWD message on MFD.

c. LOS CONT switch — Press and slew, MMS through ± 5 degrees forward trim in both azimuth and elevation. Then return MMS to 0 degrees.

d. MNL/SLAVE switch — Press to select manual mode. On MFD check MMS line of sight is steady and video remains fixed.

e. LOS CONT switch — Press to slew MMS.

f. AREA TRK switch — Press. Check AREA TRK message is displayed on MFD.

g. PNT TRK switch — Press. Check ACQ OM message displayed with target acquisition gate.

h. LOS CONT switch — Press to direct target acquisition gate to trackable target.

i. PNT TRK switch — Press.

(1) PNT TRK — Check displayed on MFD.

(2) Trackable target gate — Check gate surrounds trackable target.

(3) MMS — Check MMS slews to center trackable target gate and trackable target on display. If target moves, MMS follows to keep target and trackable target gate centered on display.

j. PNT TRK switch — Press. Check OSET ACQ message and laser hit point reticle are added to display.

k. LOS CONT switch — Press.

(1) Laser hit point reticle — Actuate to verify that laser hit point reticle responds.

(2) MFD — Check trackable target remains centered on display.

l. PNT TRK switch — Press.

(1) MFD — Check OSET TRK message is displayed and laser hit point reticle moves to center of display.

(2) Trackable target — Check not centered in display.

m. PNT TRK switch — Press. Check PNT TRK message displays.

8. Search Mode Test.

a. MMS mode select switch — SRCH.

b. MNL/SLAVE switch — Press twice to enter search mode. Check SEARCH message displays.

c. MFD — Check line address keys RAST/SPIRAL, FAST/SLOW, and WIDE/NARROW display.

(1) RAST/SPIRAL key — Press. Check both patterns are functioning.

(2) FAST/SLOW key — Press. Check both search speeds are functioning.

(3) WIDE/NARROW key — Press. Check both search options are functioning.

9. Prepoint Mode Test.

NOTE

AHRS should be in aligned condition and indicate correct location, heading, and attitude of helicopter.

a. MMS mode select switch — PREPT.

b. PPT switch — Press to enable keyboard for waypoint entry.

c. MFK — Enter known waypoint identification code.

d. MNL/SLAVE switch — Press twice to enter prepoint mode.

e. MMS — Check MMS turns to direction of selected waypoint and handover reticle appears on MFD over selected target.

NOTE

If prepoint is not accurate, perform airborne calibration and repeat prepoint check.

10. Diagnostics Check.

a. MMS mode select switch — PREFLT.

b. INIT switch — Press.

c. FDL MENU key — Press.

d. MAINTAINER CHECKS key — Press.

e. MMS DIAGNOSTICS key — Press. Record any errors.

11. Subsystem Shutdown.

    a. MMS mode select switch — STOW.

        (1) MMS — Slews to point aft.

        (2) MFD — Check video image is deleted as MMS is stowed. No messages should display for about five minutes, then STORE COMPLETE message is displayed.

NOTE

Do not set MMS mode select switch to OFF position until STORE COMPLETE message appears on MFD. MMS diagnostics records and stored data may be lost.

    b. MMS mode select switch — OFF.

D. Calibration Procedure — Airborne Cal.

Airborne Cal is a flight calibration required to correct pointing errors in the AHRS, TAMS, and MMS subsystems. Its function is to compare commanded and actual LOS angles and compute error terms that are used during PREPOINT, TARGET LOCATE, and OFFSET UPDATE operations.

1. Preflight Planning — Select three waypoints for updating and one target that is visible through the MMS from a low hover. Obtain eight digit UTM coordinates of the waypoints and target. Surveyed locations are much better than ones whose coordinates are read from a map.

2. Flight Profile — Perform fly-over update at each of the three waypoints. Then select the target to be used as NEXT WAYPOINT.

3. Position helicopter at a hover at least 3 km from the target being used. Verify the target can be point-tracked from the selected position.

4. MMS mode select switch — PREFLT.

5. SETUP key — Press.

6. AIRBORNE CAL key — Press.

7. CLEAR and STORE keys — Press to eliminate existing AIRBORNE CAL values.

8. MFD — Verify target to be used is the NEXT WAYPOINT and is at least 3 km away from present position.

9. TV or TIS narrow field-of-view — Select and point track the target.

10. While hovering, position helicopter to put target in front of helicopter. The pilot HSD shows waypoint bearing to the target. Bearing to target should be 0 ± 5 degrees relative to nose of helicopter. TGT FWD — Press.

11. Repeat step 10. except position helicopter with target to the left, right and aft and press TGT LEFT, TGT RIGHT, TGT AFT.

12. Three numbers will then be displayed. They are PITCH, ROLL, and HEADING (reading top to bottom) corrections determined during Airborne Cal.

13. STORE key — Press to load these values in nonvolatile memory.

NOTE

Failures of Airborne Cal are usually very obvious. When the following test is done and the target is not even close, sequence through the flight plan back to correct target and repeat Airborne Cal beginning at step 3.

If the following test reveals the target is close but not within narrow TV FOV or if an azimuth error exists but elevation is good, an AHRS heading error could be the cause. In this event, repeat the entire AIRBORNE CAL procedure beginning at step 1.

14. Evaluate the validity of the Airborne Cal values as follows:

    a. MMS mode select switch — PREPT while still hovering.

    b. PPT key — Press. Enter the waypoint number for target used in airborne calibration.

    c. MAN/SLAVE switch — Press to engage prepoint.

    d. The target should be within or very close to the narrow field of view in TV.

E. ATHS Operational Checks.

1. ATHS — Initialize (Refer to TM 55-1520-248-10, Appendix C).

NOTE

This check must be accomplished with a suitable ground station or with another ATHS equipped aircraft.

2. Send mayday message as follows:

   a. ATHS switch — Press. ATHS top menu page displays.

   b. MS GS/FTXT key — Press. Message type select page displays.

   c. MAYDAY key — Press. Mayday page displays.

   d. SEND key — Press. TX 1 displays as message is transmitted. ACK 1 displays when message is received.

3. Verify proper operation and grid location using voice communication with receiving station.

F. Vibration Analysis.

NOTE

Step-by-step procedures for solving vibration problems are shown in Section V.

Vibrations as a whole may be identified by category based on their frequency.

1. Low Frequency Vibration.

Low frequency vibration is defined as vibration occurring at frequencies up to 15 cps. On the OH-58D this is divided between main rotor 1/rev vibration and frequencies below main rotor 1/rev.

Main rotor 1/rev vibration is caused by mass balance differences between rotor components or lift differences between main rotor blades. The magnitude of 1/rev vibration can be controlled by adjusting the rotor using the procedures outlined in Section 5. Main rotor 1/rev vibration is divided into inplane (fore-and-aft and lateral) and out-of-plane (vertical) components. In-plane 1/rev is an out-of-balance of the rotor caused by either a mass imbalance or an out-of-track condition. Vertical 1/rev is caused by a difference in lift between rotor blades which can be corrected using either pitch link or trim tab adjustments. Expeditious correction of 1/rev vibration can be accomplished by following the procedures described in Section 5.

The OH-58D possesses unique 1/rev characteristics which must be noted by the maintenance test pilot. These characteristics are:

a. An increase in 1/rev vibration accompanied by a knocking noise can occur at idle when the cyclic is displaced too far forward or aft. Corrective action is to center the cyclic at low rpm.

b. At 100% rpm, an increase in vertical 1/rev can occur at the collective position which generates enough thrust to unload rotor. Increasing or decreasing the collective or applying some forward cyclic will correct this condition.

c. In flight, the vertical 1/rev vibration can increase at a certain torque setting (80% to 85% mast torque). This characteristic can be eliminated or minimized by following the proper procedures to work the rotor. When minimizing vertical 1/rev, avoid taking any data in this range as it will bias the results.

A low level of vibration at frequencies below main rotor 1/rev (6.5 Hz) can be felt on the ground at 100% rotor rpm. This is caused by interaction between the rotor and the skid gear and is normal. An increase in the levels of this vibration may indicate a degradation in the rubber pads in the skid gear supports or a deformation of the skid gear crosstubes due to high landing loads.

2. Medium Frequency Vibration.

Medium frequency vibrations are classified as vibrations at frequencies between 15 cps and 50 cps. On the OH-58D this would include primarily main rotor 4/rev and 8/rev vibrations as well as tail rotor 1/rev. A certain level of main rotor vibration will always be present in the airframe. An increase in these vibration levels can occur due to looseness in airframe components (stinger, landing gear, engine supports, etc.) or due to degradation in the pylon support mounts.

Tail rotor 1/rev vibration is due primarily to tail rotor out-of-balance and can be corrected by balancing the tail rotor. A sudden increase in the level of tail rotor vibration would indicate degradation of components in the tail rotor hub or in the rotor blades.

3. High Frequency Vibration.

High frequency vibration occurs at frequencies above 50 cps and are related to tail rotor 2/rev and 1/rev excitation from drive train and engine components (gearboxes, generators, etc.). These will be perceivable to the flight crew as a buzz and/or a noise in the cabin. A change in these vibrations can indicate degradation of tail rotor hub or control system components or drive train components.

4. Frequency List (Table 5-5).

The frequency list lists the predominant frequencies in the OH-58D. To isolate the source of a problem use the Chadwick Balancer to measure the frequency of the vibration at the location the crew feels it. Once the frequency has been isolated, refer to the frequency list and identify the problem source. The list recommends corrective actions for certain faults. Should the list not address the component, conduct inspections of these components. Replace if necessary.

SECTION V. CHARTS AND FORMS

General. This section contains the necessary charts and forms required to ascertain that the helicopter is performing to established standards and to record readings, pressures, RPM, etc., obtained during the maintenance test flight.

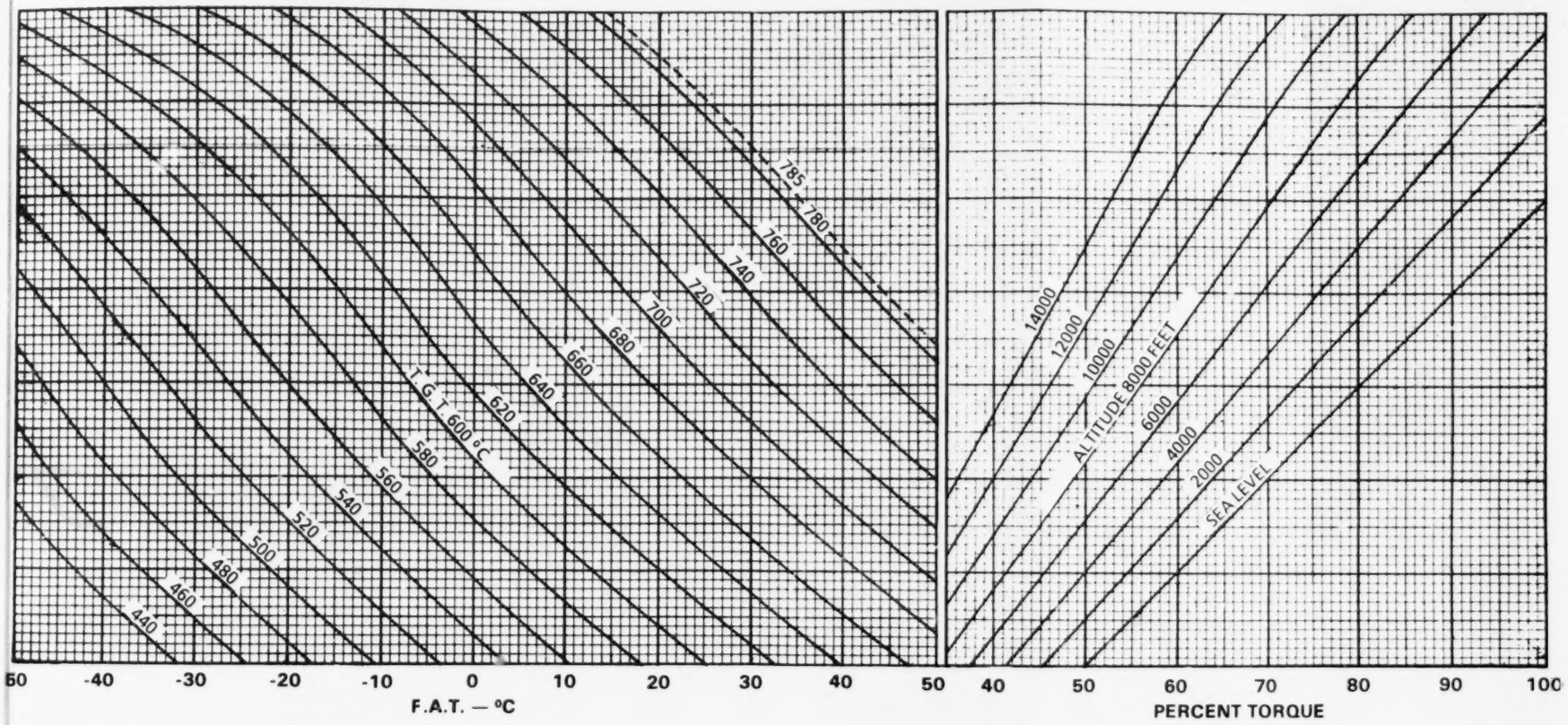
List of Charts

Figure Number	Title	Page
5-1	Power Assurance Chart	5-3
5-2	Main Rotor Track and Balance Record	5-4
5-3	Fore and Aft Balance Chart at Idle (65% NR)	5-5
5-4	Fore and Aft Balance Chart at 100% NR	5-6
5-5	OH-58D Vertical 1/rev Chart	5-7
5-6	OH-58D Rotor Smoothing Log	5-8
5-7	OH-58D MTF Chart Sheet	5-9

List of Charts (Cont)

	Title	Page
	Main Rotor Blade Preflight Setup	5-10
	Main Rotor Preflight Setup Procedure	5-11
5-	Inflight Rotor Smoothing Procedure	5-12
5-4	Troubleshooting Chart	5-13
5-5	Frequency List	5-15

POWER ASSURANCE CHART
NP—100%, BLEED AIR OFF, ZERO AIRSPEED



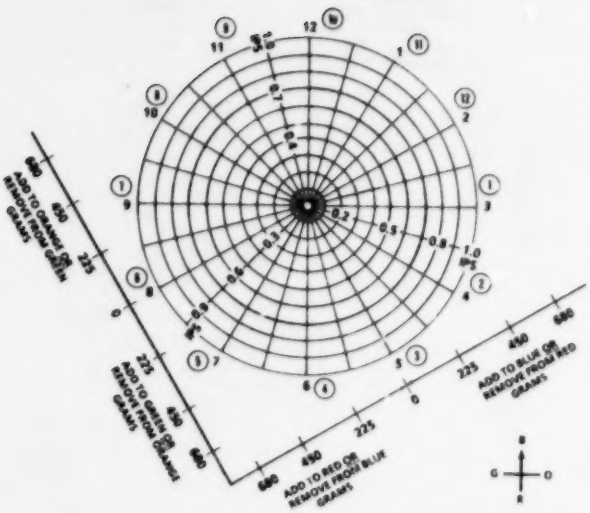
406060-3158

Figure 5-1. Power Assurance Check

FUNCTION SWITCH POSITION	IDLE	FLAT PITCH	HOVER	60 KTS	95% MAST TORQUE	CHANGE MADE
TRACK						
CHANNEL A						
CHANNEL B						
TRACK						
CHANNEL A						
CHANNEL B						
TRACK						
CHANNEL A						
CHANNEL B						
TRACK						
CHANNEL A						
CHANNEL B						

406010-309

Figure 5-2. Main Rotor Track and Balance Record



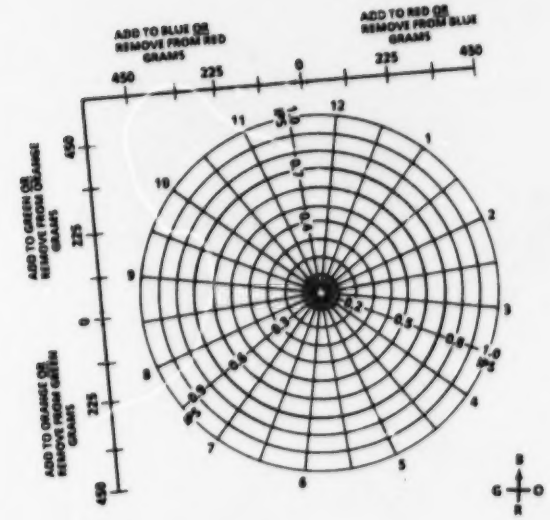
APPROXIMATE TRACK SENSITVITY AT IDLE	
P/C ADJUSTMENT	TRACK CHANGE
1 FLAT OF BARREL	1 INCH
1 TURN OF BARREL	8 INCH
1/2 TURN OF LOWER ROD END	8 INCH

NOTES

1. DATA OBTAINED AT IDLE (65% NR).
2. SET RPM TUNE DIAL TO 256.
3. SET STROBEX RPM DIAL TO 375 INITIALLY.
4. USE FORE AND AFT ACCELEROMETER.
5. CIRCLED CLOCK POSITIONS ARE FOR MMS REMOVED.

466010-310

Figure 5-3. Fore and Aft Balance Chart at Idle (65% NR)



APPROXIMATE TRACK SENSITIVITY 100% NR.

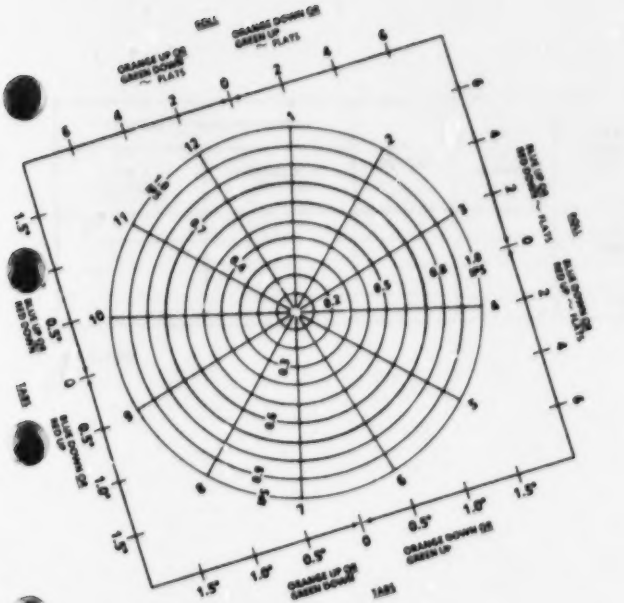
P/C ADJUSTMENT	TRACK CHANGE
1 FLAT OF BARREL	.1 INCH
1 TURN OF BARREL	.6 INCH
1/2 TURN OF LOWER ROD END	.8 INCH
1° OF TAB	.1 INCH

NOTES

1. DATA OBTAINED AT 100% NR.
2. SET RPM TUNE DIAL TO 394.
3. SET STROBEX RPM DIAL TO 600.
4. USE FORE AND AFT ACCELEROMETER.

AM0010-211

Figure 5-4. Fore and Aft Balance Chart at 100% NR



NOTES

1. USE VERTICAL ON NOSE PANEL
2. SENSITIVITIES ARE FOR 110 KTS DOUBLE THE AMOUNT OF MOVE INDICATED FOR 60 KTS
3. ROLL SENSITIVITY IN LETDOWN IS THE SAME AS 110 KTS

Figure 5-5. OH-58D Vertical 1/rev Chart

BLADE COLOR CODE	BLADE SERIAL NUMBER	TAB SETTING	NUMBER OF BALANCE WEIGHTS	
			212-010-710-1 WEIGHTS	970-4 WEIGHTS
BLUE				
ORANGE				
RED				
GREEN				

400010-308

Figure 5-6. OH-58D Rotor Smoothing Log

OH-58D MTF CHECKSHEET

PURPOSE OF TEST FLIGHT	AZPT S/N	DATE
PILOT	UNIT	

SYMBOLS: ✓ - SATISFACTORY X - DEFICIENCY

PRIOR TO MAINTERANCE TEST FLIGHT

1. FORMS AND RECORDS
2. FLIGHT READINESS INSPECTION

BEFORE STARTING ENGINE CHECK

1. FAT _____ °C
2. ALTIMETER
3. CWA SYSTEM
4. ENGINE HISTORY
5. MPD

STARTING ENGINE AND RUNUP CHECKS

1. START PEAK TGT ____ °C
   START TIME ____
2. CYCLIC FWD ____ (lb) AFT ____ (lb)
   R ____ (lb) L ____ (lb)
   COLLECTIVE ____ (lb) T/R ____ (lb)
3. HYDRAULIC SYSTEM
4. ENG IDLE SPEED CHECK
5. CONTROL OVERSPEED CHECK
6. SCAS
   HEADING HOLD
   SCAS TEST
7. COMPT BLWR
8. DEFOG BLWR
9. HTR
10. PITOT HTR
11. FUEL BOOST
12. ENGINE ANTI ICE
13. BATT PRI?
14. INSTRUMENTS R/U
    XMSN OIL P ____ PSI
    XMSN OIL T ____ °C
    ENG OIL P ____ PSI
    ENG OIL T ____ °C
    NG ____ % TGT ____ °C
    MAST TRQ ____ %
    ENG TRQ ____ %
15. POWER ASSURANCE CHECK
    ALTIMETER ____ (Hg) in.
    PA ____ ft FAT ____ °C
    TGT ____ °C NG ____ %
    ENG TRQ (chart) ____ %
    ENG TRQ (indicated) ____ %
    ENG HEALTH ____ %

AIRCRAFT HOVER CHECKS

1. HOVER POWER NG ____ %
   TGT ____ °C TRQ ____ %
2. CONTROL RESPONSE CHECK
3. SCAS
4. POWER CYLINDER CHECK
5. ENGINE RESPONSE
   FUEL CONTROL CHECK
6. HOVER BOB UP
7. DOPPLER UPDATE _____

INFLIGHT CHECKS

1. RAD ALT CHECK
2. CONTROL RIGGING
3. SCAS
4. COLLECTIVE ANTICIPATOR CHECK
5. HYDRAULIC SYS CHECK
6. AUTOROTATION NR _____ %
7. VIBRATION ANALYSIS
8. PYLON ISOLATION MOUNT CHECK
9. FLIGHT INSTRUMENTS
   VSD PAGE
   AIRSPEED INDICATION
   HEADING INDICATION
   BAROMETRIC ALTIMETER
   VSI
   ATTITUDE INDICATOR
   STANDBY FLIGHT INSTRUMENTS
   SLIP INDICATOR
   STANDBY AIRSPEED INDICATOR
   STANDBY ATTITUDE INDICATOR
   STANDBY ALTIMETER
   MAGNETIC COMPASS
10. COMMUNICATION
    FM 1 ____ UHF ____
    FM 2 ____ HF ____
    VHF ____ FM HOMING ____
    KY58 ____ TRANSPONDER ____
    KY75 ____ APR 39 ____
    ATHS _____
11. NAV SYSTEM
    WAYPOINT 1 _____
    2 ____
    3 ____
    CIRCULAR ERROR _____

ENGINE SHUTDOWN CHECKS

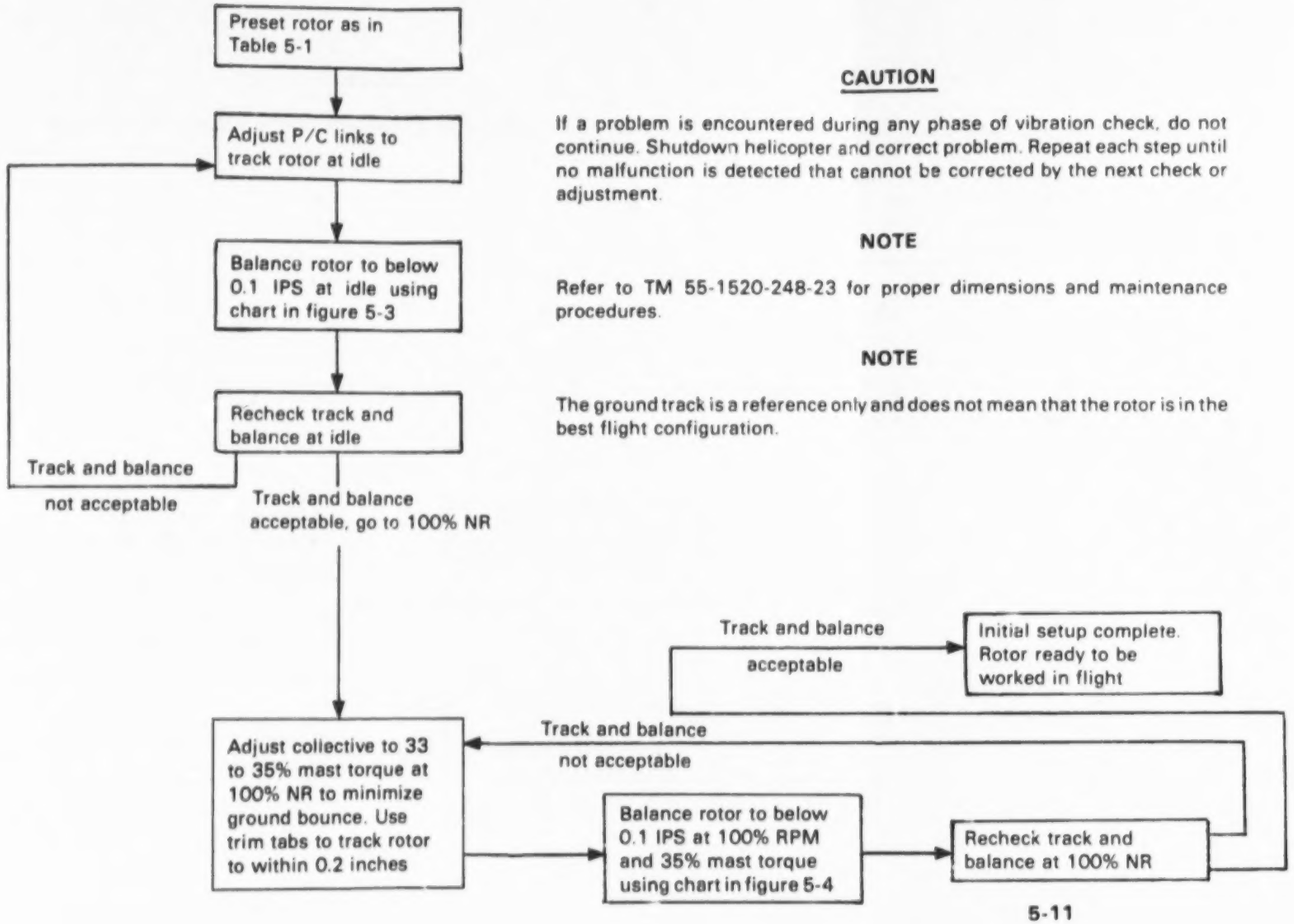
1. INSTRUMENTS S/D
   XMSN OIL P ____ PSI
   XMSN OIL T ____ °C
   ENG OIL P ____ PSI
   ENG OIL T ____ °C
   NG ____ % TGT ____ °C
   MAST TRQ _____ %
   ENG TRQ _____ %
   BATT V ____
2. THROTTLE CHECK
3. POST TEST FLIGHT INSP
4. COMPLETE UPDATE FORMS AND RECORDS
5. SPECIAL EQUIPMENT LIST

Figure 5-7. OH-58D MTF Chart Sheet (Suggested Format)

Table 5-1. Main Rotor Blade Preflight Setup

COMPONENT TO BE PRESET	MAIN ROTOR BLADE REPLACEMENT CONFIGURATION		
	NO NEW/ REPAIRED BLADES	ONE OR TWO NEW/ REPAIRED BLADES	THREE OR FOUR NEW/ REPAIRED BLADES
P/C LINKS	Do not adjust prior to flight. NOTE Any new P/C link or link with new rod end bearings should be set to length of removed link prior to installation.	Same	Same
TRIM TABS	Check and set trim tabs to setting recorded in rotor smoothing log. NOTE If recommended setting is not available leave trim tabs at original setting.	Leave trim tab setting of unreplaced blades at original setting. Adjust tabs of new/ repaired blades to setting marked on blade root end. NOTE If setting is not available set trim tab to zero degrees.	Same
HUB BALANCE WEIGHTS	Leave hub balance weights at original adjustment.	Remove hub balance weights from pairs of blades having one or more new/repaired blades.	Remove all hub balance weights.
NOTE It is not necessary to remove MMS when only checking main rotor 1/rev vertical vibrations.			

Table 5-2. Main Rotor Preflight Setup Procedure


Preset rotor as in Table 5-1
Adjust P/C links to track rotor at idle
Balance rotor to below 0.1 IPS at idle using chart in figure 5-3
Recheck track and balance at idle
Track and balance not acceptable
Track and balance acceptable, go to 100% NR
Track and balance acceptable
Initial setup complete. Rotor ready to be worked in flight
Track and balance not acceptable
Adjust collective to 33 to 35% mast torque at 100% NR to minimize ground bounce. Use trim tabs to track rotor to within 0.2 inches
Balance rotor to below 0.1 IPS at 100% RPM and 35% mast torque using chart in figure 5-4
Recheck track and balance at 100% NR

CAUTION

If a problem is encountered during any phase of vibration check, do not continue. Shutdown helicopter and correct problem. Repeat each step until no malfunction is detected that cannot be corrected by the next check or adjustment.

NOTE

Refer to TM 55-1520-248-23 for proper dimensions and maintenance procedures.

NOTE

The ground track is a reference only and does not mean that the rotor is in the best flight configuration.

Table 5-3. Inflight Rotor

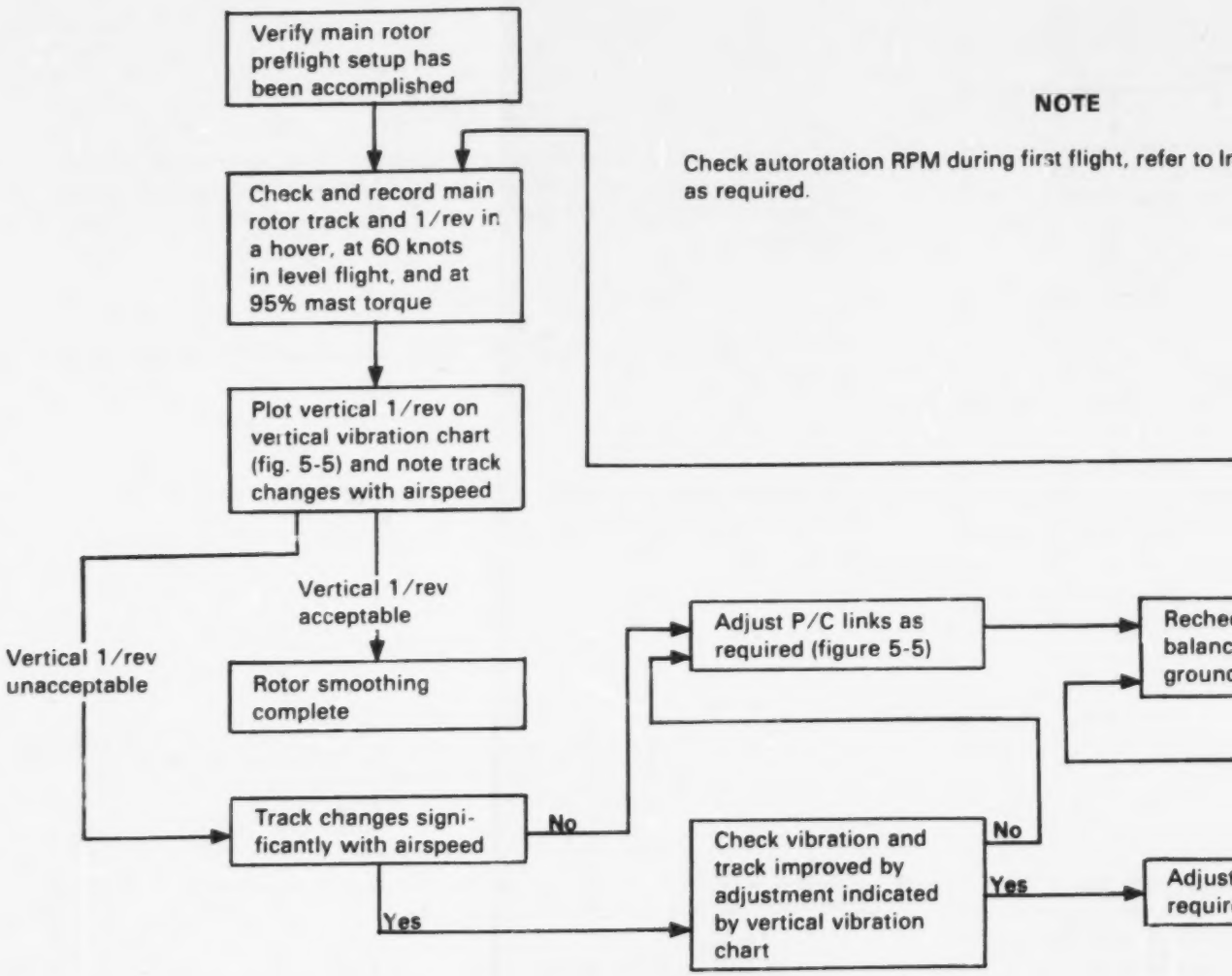

Verify main rotor preflight setup has been accomplished
Check and record main rotor track and 1/rev in a hover, at 60 knots in level flight, and at 95% mast torque
Plot vertical 1/rev on vertical vibration chart (fig. 5-5) and note track changes with airspeed
Vertical 1/rev acceptable
Vertical 1/rev unacceptable
Rotor smoothing complete
Track changes significantly with airspeed
No
Yes
Adjust P/C links as required (figure 5-5)
Check vibration and track improved by adjustment indicated by vertical vibration chart
No
Yes
NOTE
Check autorotation RPM during first flight, refer to I
as required.

Table 5-4. Troubleshooting Chart

Problem	Solution
Chart does not match moves	Check that PRESS TO TEST proper reading (12 o'clock If fails, troubleshoot mag pickup and cable.
	Use clock angle correctio 3597 supplied by Chadwick
1/rev occurs during roll into turns. Not present in a steady turn.	Low swashplate friction. C and adjust swashplate friction
Excessive 1/rev during turns	Tab or tabs not set correctly. Use tabs to stop track change with air speed. Then use pitch links to correct vertical 1/rev in level flight.
	Blade out of balance, replace blade.
Unexplained changes in 1/rev. or 4/rev.	Retorque lower hub to mast split cones.
	Check swashplate bearing for freeplay.
	Recheck swashplate friction.
	Check tail skid for looseness.
	Check aft crosstube mount for wear or rubber failure.

Table 5-4. Troubleshooting Chart (Cont)

Problem	Solution
Excessive tab adjustment or balance weight required.	Replace suspected blade.
Unexplained changes in tail rotor 1/rev.	Check tail rotor balance. If slight change in 1/rev. levels are apparent from last reading, rebalance tail rotor.
	If large changes are apparent (magnitude of 1.0 or greater in IPS), inspect hub components for wear and replace as necessary. Inspect tail rotor blades for water absorption and replace as necessary. Rebalance tail rotor.
Unexplained changes in tail rotor 2/rev.	Check tail rotor pitch link and hub bearings for wear. Replace as necessary.
Main rotor 4/rev	Check lateral engine mount for looseness, tighten or replace if necessary.
Driveshaft 1/rev	Inspect driveshafts and couplings for damage, replace if necessary.
	Inspect oil cooler fan for damage, repeat if necessary.
Driveshaft 2/rev	Inspect main driveshaft kaflex couplings and tail rotor driveshaft Thomas couplings for separation or failure.
	Check engine to transmission alignment.

Table 5-5. Frequency List

SOURCE	HARMONIC	RPM	FRE-QUENCY
MAIN ROTOR	1/REV	395	6.58
MAIN ROTOR	2/REV	790	13.17
MAIN ROTOR	4/REV	1,580	26.33
MAIN ROTOR	6/REV	2,370	39.48
TAIL ROTOR	1/REV	2,381	39.68
MAIN ROTOR	8/REV	3,160	52.67
HYDRAULIC PUMP (7 PISTON)	1/REV	4,234	70.57
TAIL ROTOR	2/REV	4,762	79.37
TAIL ROTOR	4/REV	9,524	158.73
INPUT DRIVESHAFT	2/REV	12,032	200.54
TAIL ROTOR DRIVESHAFT	1/REV	6,016	100.27
OIL COOLER BLOWER	2/REV	12,032	200.54
HYDRAULIC PUMP (7 PISTON)	7/REV	29,638	493.97
ENGINE POWER TURBINE	1/REV	30,650	510.83

Table 5-5. Frequency List (Cont)

SOURCE	HARMONIC	RPM	FRE-QUENCY
PLANETARY GEAR	MESH	39,120*	652.0
ENGINE COMPRESSOR	1/REV	51,000	850.0
90° GEARBOX GEARS	MESH	114,300*	1,905.0
XMSN SPIRAL BEVEL SET	MESH	114,300*	1,905.0

* THESE FREQUENCIES REFLECT 100% OPERATING SPEED

NOTE

Mesh frequencies do not represent a true component RPM. These are equivalent RPM values obtained by simply multiplying the mesh frequency by 60.

APPENDIX A

CDS FAULT CODES

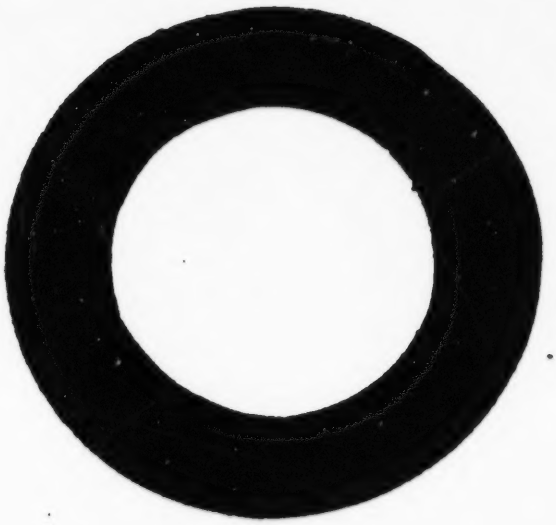
The fault codes identify faulty LRUs. Replace an LRU when a number appears on the same line as the fault code. Replace the LRUs in sequence according to the number given on the chart; for example: When a fault code of 0007 is encountered, replace the left MCPU(1) with a new one. If this does not cure the problem, replace the left MCPU with the original left MCPU and replace the right MCPU(2) with a new one. If this also does not cure the problem then replace the right MCPU(2) with the original right MCPU and replace the KU(3).

Table A-1. CDS Fault Codes

FAULT CODE	LRU TO BE REPLACED					
	LEFT MFD	RIGHT MFD	RFD	KU	LEFT MCPU	RIGHT MCPU
0001						1
0002					1	
0003					1	2
0004				1		
0005				2		1
0006				2	1	
0007				3	1	2
0008			1			
0009			2			1
000A					1	
000B			3		1	2
000C			1	2		
000D			2	3		1
000E			2	3	1	
000F			3	4	1	2
0010		1				
0011		1				2
0012		1			2	
0013		1			2	3
0014		1		2		
0015		1		3		2
0016		1		3	2	
0017		1		4	2	3
0018		1	2			
0019		1	3			2
001A		1	3		2	
001B		1	4		2	3
001C		1	2	3		
001D		1	3	4		2
001E		1	3	4	2	
001F		1	4	5	2	3
0020	1					

Table A-1. CDS Fault Codes (Cont)

FAULT CODE	LRU TO BE REPLACED					
	LEFT MFD	RIGHT MFD	RFD	KU	LEFT MCPU	RIGHT MCPU
0021	1					2
0022	1				2	
0023	1				2	3
0024	1			2		
0025	1			3		2
0026	1			3	2	
0027	1			4	2	3
0028	1		2			
0029	1		3			2
002A	1		3		2	
002B	1		4		2	3
002C	1		2	3		
002D	1		3	4		2
002E	1		3	4	2	
002F	1		4	5	2	3
0030	1	2				
0031	1					3
0032	1	2			3	
0033	1	2			3	4
0034	1	2		3		
0035	1	2		4		3
0036	1	2		4	3	
0037	1	2		5	3	4
0038	1	2	3			
0039	1	2	4			3
003A	1	2	4		3	
003B	1	2	5		3	4
003C	1	2	3	4		
003D	1	2	4	5		3
003E	1	2	4	5	3	
003F	1	2	5	6	3	4



APPENDIX B

FAULT DETECTION LOCATION SYSTEM (FDLS) FAILURE CODES

B-1. FDLS FAILURE CODES

This appendix contains a listing of the FDLS Fault Codes.

B-2. BUILT-IN-TEST

An operator calls up the built-in-test (BIT) page (figures B-1 and B-2) from FDL MENU by pressing line address key L1. The helicopter must be on the ground to access this page. The BIT page provides control and display of built-in fault detection and isolation for the OH-58D.

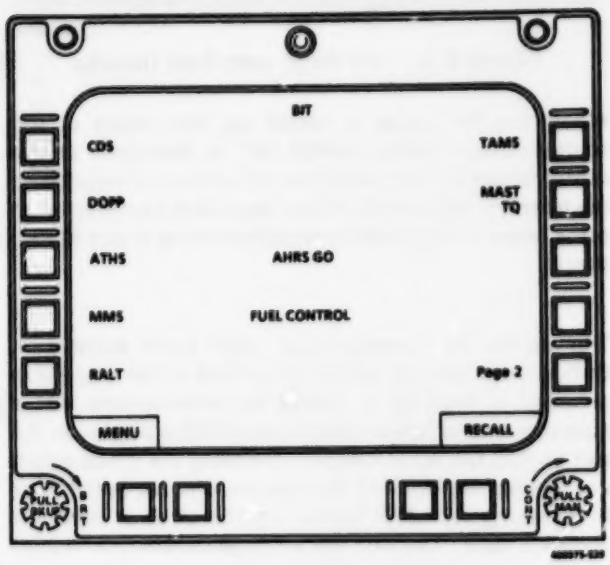


Figure B-1. Built-In-Test (BIT) Page

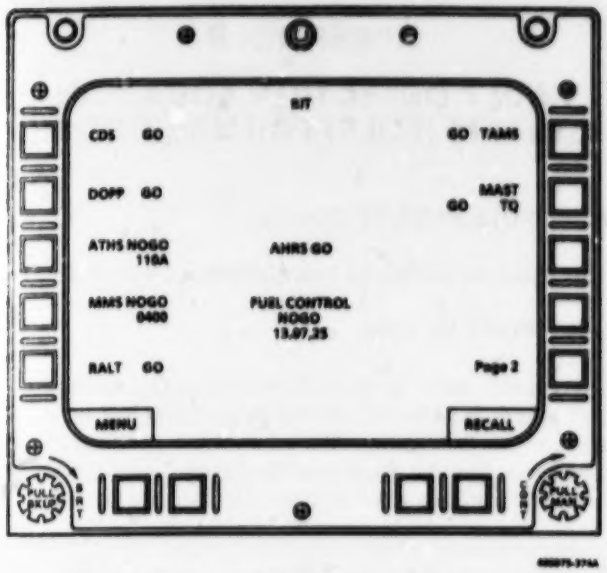


Figure B-2. BIT Page with Test Results

When the BIT page is called up, the result of the continuously running AHRS BIT is displayed at the center of the screen. All other BITs must be initiated by the operator as described in subsequent paragraphs. In some cases a fault code is identified along with a NOGO status.

The ability to communicate with each subsystem through the aircraft wiring is verified when any BIT is selected. If the CDS is unable to communicate with a subsystem, a failure is noted and NOGO is displayed. An exit to FDL MENU is made by pressing the mode select key labeled MENU. The operator exits to the Initial Page by pressing the INIT button on the pilot or observer auxiliary panel. Leaving the BIT page causes GO/NOGO conditions and fault codes to be cleared from the page.

The BIT functions and their respective paragraphs are:

BIT	PARAGRAPH
LAST FLIGHT RECALL	B-3
AHRS BIT	B-4
FUEL CONTROL BIT	B-5
CDS BIT	B-6
DOPPLER RADAR BIT	B-7
ATHS BIT	B-8
MMS BIT	B-9
RADAR ALTIMETER BIT	B-10
TRANSMISSION ATTITUDE MEASUREMENT SUBSYSTEM (TAMS) BIT	B-11
MAST TORQUE BIT	B-12
AUDIO DISTRIBUTION UNIT (ADU) BIT	B-13
IFM AMPLIFIER BIT	B-14
RADIO BIT	B-15
HF RADIO BIT	B-16
SCAS BIT	B-17
IFF BIT	B-18
MUX BUS STATUS	B-19

Each digit of the fault code indicates the failure status for four built-in-tests. See Table B-1. To learn which self tests have failed, compare each digit with the table. An X indicates a built-in-test has failed. The number 3 in the first digit indicates tests 12 and 13 have failed. The following are examples of typical fault codes and the built-in-tests they indicate as having failed.

TYPICAL FAULT CODE	BUILT-IN-TESTS FAILED
0040	06
1010	12, 04
A10B	15, 13, 08, 03, 01, 00
4230	14, 09, 05, 04

Table B-1. Fault Code Conversion

DIGIT DISPLAYED	FIRST DIGIT Tests Failed				SECOND DIGIT Tests Failed				THIRD DIGIT Tests Failed				FOURTH DIGIT Tests Failed			
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
0																
1				X				X				X				X
2			X				X				X				X	
3			X	X			X	X			X	X			X	X
4		X				X				X				X		
5		X		X		X		X		X		X		X		X
6		X	X			X	X			X	X			X	X	
7		X	X	X		X	X	X		X	X	X		X	X	X
8	X				X				X				X			
9	X			X	X			X	X			X	X			X
A	X		X		X		X		X		X		X		X	
B	X		X	X	X		X	X	X		X	X	X		X	X
C	X	X			X	X			X	X			X	X		
D	X	X		X	X	X		X	X	X		X	X	X		X
E	X	X	X		X	X	X		X	X	X		X	X	X	
F	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

B-3. LAST FLIGHT RECALL

Selecting the RECALL button will bring up the RECALL page (Figure B-3). The recall data shows failures for the SCAS, Navigational System, and CDS when normal engine shutdown was performed at the end of the last flight. If the NOGO condition is indicated, fault codes are displayed on the line below. There are 61 possible tests. A fault code appears as a decimal number. Multiple fault codes are separated by commas with four fault codes per line. Only the first eight fault codes generated will be displayed. Refer to table B-1 to identify the built-in-test that has failed. The fault codes provide information on built-in-test as follows:

*TEST NUMBER (FAULT CODE 1)	ACTION ITEM	TEST DESCRIPTION
01		Processor Test Failure
02		ROM Check Sum Failure
03		A/D +15 Vdc Invalid
04		+14 Vdc Invalid
05		1553 Data Wraparound Invalid
06		RTI Fail Line Test
07		+/-10 Vdc Ref Failed
08		15 Vdc AET Failed
09		Data Bus Test #1 Failure
10		Data Bus Test #2 Failure
11		Data Bus Test #3 Failure
12		UART Wraparound Failure
13		Type G Radio Output Failure
14		Type AA Radio Output Failure
15		Type F Radio Output Failure

*Spare TEST NUMBERS are not called out.

*TEST NUMBER (FAULT CODE 2)	ACTION ITEM	TEST DESCRIPTION
00		AHRS Data Not Changing
01		AHRS Validity Discrete (Hard Wire)
02		AHRS Validity Discrete Invalid (1553)
03		AHRS/Gyro Roll Rate Mistrack
04		AHRS/Gyro Pitch Rate Mistrack
05		AHRS/Gyro Yaw Rate Mistrack
06		Second Yaw Rate Mistrack
07		Pitch Stick Inputs Mistrack
08		Roll Stick Inputs Mistrack
09		Pedal Inputs Mistrack
11		Collective Stick Inputs Mistrack
13		Airspeed Input Invalid
14		Engine Torque Input Invalid
15		SCAS Summed Wraparound Invalid

*Spare TEST NUMBERS are not called out.

*TEST NUMBER	ACTION ITEM	TEST DESCRIPTION
(FAULT CODE 3)		
00		26 Vac Ref Failed
01		+/-5 Vac Failed
02		Left Cyclic Model Mistrack
03		Right Cyclic Model Mistrack
04		Yaw Model Mistrack
05		Second Yaw Model Mistrack
06		Trim Rate Model Mistrack
10		P/R Latch W/A Discrete Invalid
11		Yaw Latch W/A Discrete Invalid
12		P/R Solenoid W/A Discrete Invalid
13		Yaw Solenoid W/A Discrete Invalid
14		Trim Brake/Spare W/A Discrete Invalid
15		Trim Clutch/Tru Control W/A Discrete Invalid

*Spare TEST NUMBERS are not called out.

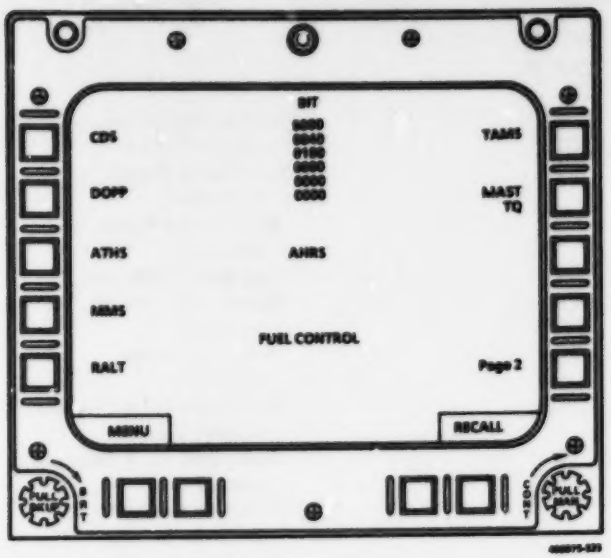


Figure B-3. Recall Page

TEST NUMBER	ACTION ITEM	TEST DESCRIPTION
(FAULT CODE 4)		
00		SCAS Discrete Output Bit Pattern Invalid
01		Doppler Validity Invalid
02		Doppler In Memory
03		AHRS Not Aligned
04		Power Supply Over Temperature

TEST NUMBER	ACTION ITEM	TEST DESCRIPTION
(FAULT CODE 5)		
01		RIGHT MFD #1 Failed
02		LEFT MFD #2 Failed
03		KU Data Stream Check — Sum Valid
04		KU Bit Indicators Failed
05		KU Bit Test Pattern Invalid
06		MUX #1 Test Failed
07		MUX #2 Test Failed
08		MUX #3 Test Failed
09		MUX #4 Test Failed
10		MUX #5 Test Failed
11		MUX #6 Test Failed
12		MUX #7 Test Failed
13		+5 Vdc Test Failed
14		MMS Failed

B-4. AHRS BIT

A GO or NOGO condition is indicated at the center of the display when the BIT page is called up. No operator interaction is required.

B-5. FUEL CONTROL BIT

The operator presses the DIGITAL test switch on the Fuel Control Test Panel (figure B-4) to initiate the fuel control BIT. The words GO or NOGO appear on the line below FUEL CONTROL when the BIT is completed (figure B-2). If the NOGO condition is indicated, fault codes are displayed on the line below. There are 22 possible fault codes. A fault code appears as a two-digit number. Multiple fault codes are separated by commas

with four fault codes per line. Only the first eight fault codes generated will be displayed. The fault codes are as follows:

FAULT CODE	FAULT
00	Fueling Open Circuit
01	End of Message Not Received
*11	NP(A) vs NP(B)
*12	NG(A) vs NG(B)
*13	NP
*14	NP
15	NG
16	NG
23	Driver Open
24	Coil Open
25	Coil Shorted
26	Driver Shorted
31	Overspeed Solenoid
32	MGT
33	Ambient Pressure
34	Collective Pitch
42	A/D Converter Ref.
43	A/D Converter
44	Counter I/O No. 2
45	Counter I/O No. 1
61	COP

FAULT CODE	ACTION ITEM
21, 22, 35, 36, 41, 55, 62	Central Processor and Memory Faults

*If replacement of the Digital Fuel Control does not fix this fault, or if a replacement unit is not available, perform troubleshooting using wiring diagrams (TM 55-1520-248-23) for the appropriate signal required.

406075-9A
406-075-139

Figure B-4. Fuel Control Test Panel

B-6. CDS BIT

Pressing line address key L1 initiates the CDS BIT. A GO or NOGO condition is displayed next to the word CDS. When a NOGO condition exists, the failed LRU will be identified by a four-digit fault code appearing below the words CDS NOGO. The fault codes, decoded using table B-1, identify tests that failed. Replace LRU that corresponds to failed test numbers. For example, a fault code of 000C indicates the RFD and the KU must be replaced. A fault code of 0010 indicates the right MFD must be replaced.

NOTE

When a multiple fault is indicated, replace one LRU at a time. If replacement of first LRU does not clear the fault, remove the replacement LRU and install the original LRU. Replace the second LRU. If replacement of second LRU does not clear the fault, remove the replacement LRU and install the original LRU. Proceed through replacement of multiple LRU's utilizing this procedure.

TEST NUMBER	ACTION ITEM (Replace)	TEST DESCRIPTION
00	Right MCPU	Right MCPU
01	Left MCPU	Left MCPU
02	KU	KU
03	RFD	RFD
04	Right MFD	Right MFD
05	Left MFD	Left MFD

B-7. DOPPLER RADAR BIT

Pressing line address key L2 initiates the doppler radar (DOPP) BIT. A GO or NOGO condition appears next to the word DOPP. The status of the doppler will be expressed in alphanumeric code words that appear below the word DOPP. The fault codes are:

FAULT CODE	FAILURE/CONDITION
GO	System good
EN	Battery missing or defective
GO P	Problem with pitch/roll input/ phasing or amplitude or 1553 pitch/roll input
*MN H	Problem with heading input amplitude or 1553 heading input
*MN R	Receiver/Transmitter failure

FAULT CODE	FAILURE/CONDITION
*MN S 1371	Doppler Converter Tracking failure
*MN S 1372	Doppler Converter Input/Output failure
*MN S 1373	Doppler Converter 1553 Input/ Output failure
*MN S 1374	Doppler Converter Central Processing Unit/Memory failure
*MN S 1375	Doppler Converter Power Supply failure
NO R	Receiver/Transmitter not connected
PP	Program Plug miswired or missing

*BU (Automatic Back Up Operation) or NG (System Not Operational) can appear instead of MN (Manual Navigation).

B-8. ATHS BIT

Pressing line address key L3 initiates the ATHS BIT. A GO or NOGO condition is indicated next to the word ATHS.

In some cases the BIT can identify a faulty LRU. A four-digit fault code appears beneath the words ATHS

NOGO when a built-in-test has failed. Refer to table B-1 for decoding. The fault code provides information on 13 built-in-tests as follows:

TEST NUMBER	ACTION ITEM	TEST DESCRIPTION
01	**	AVIONIC CONTROLLER
02	**	AUDIO SWITCH
03	**	MODEM
04	**	MODEM CONTROL
05	**	READ/WRITE MEMORY
06	**	EPROM NO. 3
07	**	EPROM NO. 2
08	**	EPROM NO. 1
09	**	CPU
10	**	1553 SUBSYSTEM INTERFACE
11	**	1553 ENCODE/DECODE
12	**	1553 VALIDATION
13	**	1553 ANALOG

**Replace ATHS signal condition.

B-9. MMS BIT

Pressing line address key L4 initiates the MMS BIT. A GO or NOGO condition is indicated next to the word MMS.

In some cases the BIT can identify a faulty LRU. A four-digit fault code appears beneath the words MMS

NOGO when a built-in-test has failed. The fault code provides information on 16 built-in-tests as follows:

TEST NUMBER	ACTION ITEM (Replace)	TEST DESCRIPTION
00	—	MMS POWER ON BIT
01	MCPS	MCPS BIT STATUS
02	MSP	MSP DSC BIT
03	MSP	MSP VTS BIT
04	MSP	MSP 771 BIT
05	MSP	MSP GENERAL BIT
06	—	TURRET BIT
07	IEA	IEA BIT
08	OBS	OBS BIT
09	TCU	TCU BIT
10	TIS	TIS BIT
11	TVS	TVS BIT
12	GEA	GEA BIT
13	GBA	GBA BIT
14	LRF/D	LRF/D
15	—	MMS LRU CONTINUOUS BIT

Each digit of fault code indicates the failure status for four built-in-tests. See table B-1. To learn which self-tests have failed, compare each digit with the table. An X indicates a built-in-test has failed. The number 3 in the first digit indicates tests 12 and 13 have failed. The following are examples of typical fault codes and the built-in-tests they indicate as having failed.

TYPICAL FAULT CODE	BUILT-IN-TESTS FAILED
0040	06
1010	12,04
A108	15, 13, 08, 03
4230	14, 09, 05, 04

B-10. RADAR ALTIMETER BIT

Pressing line address key L5 initiates the radar altimeter (RALT) BIT. A GO or NOGO condition is indicated next to the word RALT. No fault codes are identified.

If a NOGO is indicated without a failure code:

a. Verify the NOGO is valid by performing Radar Altimeter operational check (TM 11-1520-248-23).

b. Proceed to appropriate troubleshooting procedure (MAPS).

B-11. TRANSMISSION ATTITUDE MEASUREMENT SUBSYSTEM (TAMS) BIT

Pressing line address key R1 initiates the TAMS BIT. A GO or NOGO condition is indicated next to the word TAMS. A four-digit fault code appears beneath the words NOGO TAMS when a self-test has failed. The fault codes, shown in table B-1 indicate which unit has failed. Replace or repair a unit when an X appears in the same line as the fault code. For example, a fault code of 0003 indicates the left aft LVDT and the TAMS signal conditioning unit must be replaced.

NOTE

When a multiple fault is indicated, replace or repair one unit at a time. If replacement or repair of first unit does not clear the fault, remove (if no repair was required) and install the original unit. Replace or repair the second unit. If replacement or repair of second unit does not clear the fault, install the original unit. Proceed through replacement or repair of multiple units utilizing this procedure.

ACTION ITEM (Replace)	TEST DESCRIPTION	
	TAMS Signal Conditioning Unit	Signal Conditioning Unit
01	Left Aft LVDT	Left Aft LVDT
02	Left Fwd LVDT	Left Fwd LVDT
03	Right Aft LVDT	Right Aft LVDT
04	Right Fwd LVDT	Right Fwd LVDT

B-12. MAST TORQUE BIT

Pressing line address key R2 initiates the mast torque BIT. A GO or NOGO condition is indicated next to the words MAST TQ. No fault codes are identified.

If a NOGO is indicated without a failure code:

a. Verify that NOGO is valid by performing Mast Torque operational check (TM 11-1520-248-23).

b. Proceed to appropriate troubleshooting procedure (MAPS).

B-13. AUDIO DISTRIBUTION UNIT (ADU) BIT

Pressing line address key R1 on BIT page 2 initiates the ADU BIT. A GO or NOGO condition is indicated next to the word ADU. No fault codes are identified.

If a NOGO is indicated:

a. Verify the NOGO is valid by performing ADU operational check (TM 11-1520-248-23).

b. Proceed to appropriate troubleshooting procedure (MAPS).

B-14. IFM AMPLIFIER BIT

Pressing line address key R2 on BIT page 2 initiates the IFM BIT. A GO or NOGO condition is indicated next to the word IFM. The following fault codes are identified if NOGO appears:

FAULT CODE	ACTION ITEM	TEST DESCRIPTION
04	•	VPA Fault
01	•	Power Level Fault
05	•	VPA and Power Level Fault

Replace IFM amplifier.

B-15. RADIO BIT

On BIT page 2 keys L1, L2, L3, L5 initiates BIT for the FM-1, UHF, VHF, and FM 2 radios respectively. A GO or NOGO indication is displayed. No fault codes are displayed.

B-16. HF RADIO BIT

Pressing line address key L4 on BIT page 2 initiates the HF radio BIT. A GO or NOGO condition is indicated next to the word HF.

If a NOGO is indicated without a failure code:

a. Verify the NOGO is valid by performing HF radio operational check (TM 11-1520-248-23).

b. Proceed to appropriate troubleshooting procedure (MAPS).

FAULT CODE	ACTION ITEM	TEST DESCRIPTION
0001	Check/Replace Antenna Connections	Antenna Coupler
0002	Replace HF Radio	Receiver/Exciter Fail
0003	Do both ACTION ITEMs above	Antenna Coupler and Receiver/Exciter Fail

B-17. SCAS BIT

On the initial page select FDL (line select switch R3) while on the ground. This will bring up another page. Press BIT (line select switch L1). This will bring up another page. In the lower right hand corner (in place of the COMM line select switch), press RECALL (line select switch D). This will display the failure codes which look the same as MEMORY INSPECT on the SCAS Flight Test Page. The displayed failure codes will be from the last flight. Power must be turned off and back on after the last flight to display the last failures. These are updated each time the helicopter lands, turns power off then back on and is airborne again. The following is a list of the failure codes, and corresponding failures for each code as seen on the MFD. The fault codes, shown in Table B-1, identify faulty LRU. Replace an LRU when an * appears on the same line as the action item on page B-20.

TEST NUMBER	ACTION ITEM	TEST DESCRIPTION
FAULT CODE 1		
00	*Right MCPU	Right MCPU Test
01	*Left MCPU	Left MCPU Test
02	—	Not Used
03	—	Not Used
04	—	Not Used
05	—	Not Used
06	*Yaw Actuator	Yaw Actuator Test
07	*Right Cyclic Actuator	Right Cyclic Actuator
08	*Left Cyclic Actuator	Left Cyclic Actuator
09	*Pitch Rate Gyro	Pitch Rate Gyro
10	*Roll Rate Gyro	Roll Rate Gyro
11	*Yaw Rate Gyro	Yaw Rate Gyro
12	*Fore/Aft Cyclic CMT	Fore/Aft Cyclic CMT
13	*Lateral Cyclic CMT	Lateral Cyclic CMT
14	*Pedal CMT	Pedal CMT
15	*Collective CMT	Collective CMT
FAULT CODE 2		
00	*Airspeed Sensor	Airspeed Sensor
01	*Torque Sensor	Torque Sensor Not Used
02	—	Not Used
03	*Trim Motor	Trim Motor
04	Check 26 VAC	26 VAC System Test
05 thru 15	—	Not Used

NOTE

In flight failures of the SCAS system are displayed with the LAST FLIGHT RECALL fault codes (paragraph B-3).

B-18. IFF BIT

Pressing key R3 on BIT page 2 causes the IFF page 2 (figure B-5) to be displayed. No fault codes are displayed for the IFF. Six self tests can be selected. GO or NOGO is displayed for each test.

M1 TEST (MODE 1)
M2 TEST (MODE 2)
M3 TEST (MODE 3)
M4 TEST (MODE 4)
MC TEST (MODE C)
RAD TEST (Transmitter Test)

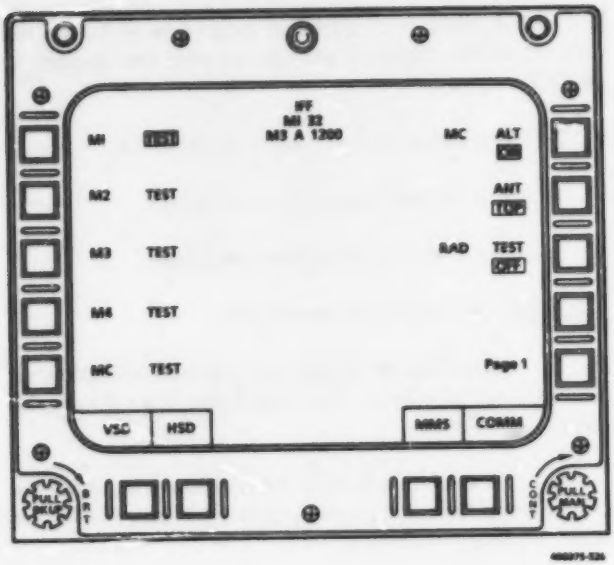


Figure B-5. IFF BIT Page

B-19. MUX BUS STATUS

BIT page 3 displays the status of LRUs interfaced on the MIL-STD-1553 multiplex (MUX) data bus. Two bus cables are installed in the helicopter, Bus A and Bus B. Each LRU can use either bus. The system periodically tests each LRU on each bus. The results are displayed on BIT page 3, (figure B-6). The device refers to the LRU being tested and a GO or NOGO status is displayed for both Bus A and Bus B. Since these busses are redundant, a NOGO status can be displayed for a device, but since the other bus is still GO, the device will still function normally with no apparent problem.

1. The MUX BUS STATUS data is used to update failures of the data bus cables and also the devices. A NOGO means either:

   a. The cable to that device is defective.

   b. The device has an internal failure.

   c. The device is off or not installed.

2. Use the following guidelines:

   a. If a device is NOGO for one bus and all other devices on that bus are GO, repair the bus cable to the device (see note).

   b. If a device is NOGO for both busses, check for proper installation of and wiring to the device, if they are okay, replace the device.

   c. If all or several devices are NOGO on the same bus, repair the bus cable (see note). By comparing the devices that are NOGO with the physical layout of the bus, the problem can be isolated to one cable segment or ccupler.

d. For the example shown in Figure B-6 the AHRS, bus B cable and IFM bus cable (see note) should be replaced and the VHF radio should be replaced.

NOTE

If replacing the cable segment does not solve the problem, replace the data bus coupler module.

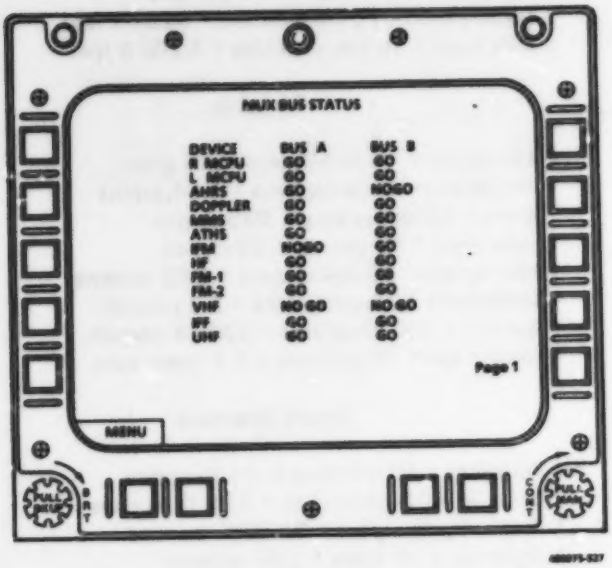


Figure B-6. MUX Bus Status

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimenter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigrams = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 38.82 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

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